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DEVOTED TO THE INTERESTS OF RAILWAY ROLLING STOCK

R. M. VAN ARSDALE, Proprietor.

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PUBLICATION OFFICE:

MORSE BUILDING, NEW YORK.

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NATIONAL CAR AND LOCOMOTIVE BUILDER

JANUARY, 1890.

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The New York, Providence & Boston are getting out specifications for fourteen new passenger cars.

The Kansas City, Fort Scott & Memphis has just placed in service three new passenger cars built at its shops near Kansas City.

The Rio Grande Western has now received twelve of its standard gauge locomotives, and these are all in service on the part of the road which has been made standard gauge.

The Indianapolis Car & Manufacturing Company is delivering 25 box cars daily to the Lake Shore & Michigan Southern on the order for 500 placed with the company a few weeks ago.

The Louisville, New Albany & Chicago has received two additional consolidation locomotives, part of an order recently placed in the East. The company expects four more engines next month.

The Sioux City & Northern has now in service six locomotives, six passenger and three baggage cars and five cabooses, all new. The company has also in service 100 platform, 100 box and 100 stock cars.

The Brooks Locomotive Works have recently built some ten-wheel engines for Cuba. The engines attracted great attention, being very gorgeously finished in bright colors and a lavish quantity of polished brass.

The Westinghouse automatic air-brake is now in use on 20,000 engines and 195,000 cars. This includes 95,000 freight cars. Orders have been given for 45,000 sets of the improved quick-action brake during the last year.

The new mogul freight locomotives lately put in service by the New York Central Railroad Company are regularly pulling trains of 60 loaded eight-wheel cars. One of these engines could take 60 loaded cars from Chicago to New York without assistance.

The ten-wheel passenger locomotives built by the Schenectady Locomotive Works for the Michigan Central do the work of hauling the long fast trains with twenty-five per cent. less fuel than was used by the small eight-wheel engines that formerly did the work.

The Wisconsin Central are about to have built at the Brooks Locomotive Works ten new locomotives for heavy passenger service. The design has not yet been settled upon. Heavy ten-wheel engines were spoken of, but there is a question whether or not the bridges would safely carry the weight proposed.

It is rumored that the Grant Locomotive Works Company, of Paterson, has been re-organized, and that new works will be built near Chicago. The greater part of the new capital put into the concern is said to come from the West, and it is reported that Mr. E. T. Jeffery, lately of the Illinois Central, will have charge as general manager.

The Pittsburgh Locomotive Works people are making very important additions to their shops. A few years ago they built what is the finest and best equipped iron foundry in the country and they have now erected a fine boiler shop that will have every facility that can be used to facilitate the construction of boilers. They are going to have the most approved hydraulic machinery for riveting and flanging, and their cranes will be operated by the same power. The intention is to build a new machine shop of sufficient size to double the capacity of the works. They are very busy with the building of locomotives that are nearly all particularly heavy.

The New York Central has shortened the time of its new Southern Limited, starting it now from New York at 10:50 A. M., two hours later than before. It arrives at St. Louis at six o'clock the following evening. The fast mail continues to leave New York at 8:50, the train being converted into a "New York State Express," having drawing-room cars for Canandaigua and Buffalo. The old Chicago express, which for years has left at 10:30 A. M. and reached Chicago at six o'clock or later the following evening, has been accelerated; it now leaves at 11:50 and reaches Chicago by the Michigan Central at 4:35 the following afternoon, making the running time nearly as short as that of the train leaving at 6 P. M.

According to the *Annales Industrielles*, a means has been found of transforming liquid petroleum into solid blocks. The material thus formed can be easily transported, is a very convenient fuel, and has the additional advantage of being perfectly safe as regards spontaneous combustion. The samples submitted to the Société d'Encouragement could be easily cut with a knife, and were at the same time solid enough to be handled without inconvenience. In this form petroleum does not catch fire over the whole surface at once, but burns slowly like wood. The heat produced by it is three times as great as that of oil, and the blocks leave but a small quantity of ash. Solid petroleum liquifies only at 212 degrees F., and can be easily molded into any shape desired without losing any of its properties. The treatment is simple, practical and inexpensive. This new fuel certainly seems to have a great future, and is very likely to be adopted for railway purposes.

Although every one is perfectly familiar with the use of the auger, but comparatively few know the process of its manufacture. In making augers, the iron which forms the main or spiral part is welded into the steel of which the tip is made before forging. The bar is then put under hammers and forged into shape. It is then put in what is called "a wringing machine" and twisted up in a rough state into the spiral form, after which it is passed through "crimpers," giving a uniformity of twist. The augers are next put through "straighteners" and revolved, making them perfectly straight, when they are ready for putting on the head, which is the most delicate operation in their manufacture, and requires the work of a skilled artisan. They are then subjected to a "grinding out process, which consists of putting them through two emery wheels to rough-polish the twist. The "fitter-up" then takes hold of them and "lightens" or fits the head; then the filers file down and sharpen the heads, after which they pass through the hands of the polishers, where they are polished and hardened ready for the market.

About the most fortunate people to be found are individuals who have enjoyed the felicity of getting shaken up or slightly hurt on railroads in or about New York where courts and juries delight in giving damages. Cases which are really robberies are called justice in New York because the parties stolen from are rich corporations. Three cases were decided in one day last month giving heavy damages that never would have come into court had the defendants been private individuals. A jury before the Superior Court found a verdict for $1,500 in favor of Morris Quinlan, aged nine, against the Manhattan Elevated Railroad Company. A board fell from the track and struck him on the head, injuring his eyesight. David Mosseman recovered a verdict for $5,000 from a jury before Judge Allen in the Court of Common Pleas against the Metropolitan Elevated Railroad Company. A crowbar fell from the track and crushed his foot. Joshua F. Page recovered a verdict for $15,000 from a jury before Judge Beach in the Supreme Court against the cities of New York and Brooklyn, for injuries received from a collision of cars on the East River Bridge.

An account is given in the *Berliner* of a soft alloy which adheres so firmly to metallic, glass and porcelain surfaces that it can be used as a solder, and which, in fact, is invaluable, when the articles to be soldered are of such a nature that they cannot bear a high degree of temperature, the composition consisting of finely pulverized copper dust, which is obtained by shaking a solution of sulphate of copper with granulated zinc. The temperature of the solution rises considerably, and the metallic copper is precipitated in the form of a brownish powder—20, 30 or 36 parts of this copper dust, according to the hardness desired, being placed in a cast-iron or porcelain-lined mortar, and well mixed with some sulphuric acid having a specific gravity of 1.85. To the paste thus formed are added 70 parts by weight of mercury, with constant stirring, and when thus thoroughly mixed the amalgam is well rained in warm water to remove the acid and then set aside to cool; in ten or twelve hours it is hard enough to scratch tin. On being used it is heated to a temperature of 375 degrees Centigrade, and when kneaded in an iron mortar becomes as soft as wax, in this ductile state it can be spread upon any surface, to which, as it cools and hardens, it adheres with great tenacity.

According to the *Engineering News*, the total addition to the main track mileage of railways in the United States during the past year has been a little short of 5,000 miles. This is the smallest construction recorded since 1885. The bulk of the year's construction has been done in the South. Over 2,000 miles of the new lines reported to us lie south of the latitude of Cincinnati and east of the Mississippi River. Washington, however, has had the greatest increase in railways of any single State, 353 miles having been built there in 1889. Georgia comes next with 315 miles, and then follow North Carolina, with 274 miles; Texas, with 270 miles, and Mississippi, with 212 miles. Sixteen other States report between 100 and 200 miles, and in Vermont, Rhode Island, New Mexico, Arizona and Nevada no new track-laying has been reported. Very few long lines have been built this season, but there has been a great number of new short branches and extensions, especially in the East. The total number of separate lines on which track was laid during the year was 253. This work was done by 197 different companies. The average length of each extension, therefore, was almost exactly nineteen and one-half miles. In Canada, during 1889, 733 miles of track were laid, and in Mexico the construction amounted to 369 miles.

The Lake Shore Foundry Company, of Cleveland, have sent out a highly amusing circular respecting the service of railroad cars. The railroad car departments are always at semi-frequent intervals sending out fierce manifestos threatening pains and penalties to be inflicted on users of cars who do not unload promptly. The latest phase of this regularly recurring excitement is the formation of a car service association, which is going to inflict demurrage charges upon every transgressor against rules calling for the expeditious unloading of cars. This association has sent out notices laying down stringent rules, and, as usual, most of car users have paid no heed to the matter. But the Lake Shore Foundry Company have retaliated. It is well known that car users suffer quite as much from the common practice of railroad companies permitting cars to remain for days in yards where they cannot be reached, as the companies suffer from the practice of using cars as store-houses. The foundry company named on receiving the notice about the new penalties for delay in unloading, have fought their side of the question by issuing a set of rules for railroad companies respecting the placing of cars that arrive with freight. They propose to inflict fines upon the railroad companies that do not send cars promptly to the side track for unloading after arrival in the yard; and they have just as much right to make charges for delay and inconvenience as railroad companies have for delays in unloading.

D., L. & W. Shops at Buffalo.

During a recent brief visit to the shops of the Delaware, Lackawanna & Western at Buffalo, we found our genial friend, Master Mechanic F. W. Griffith, up to his neck in business trying to make a first-class record with work done in shops ridiculously inadequate for the business to be carried on in them. The shops there form the worst example of bad original design that we have ever seen. The main shop is a fine building so far as the walls are concerned, and it has an attempt at a monitor roof, which would give good light beneath if it was not excluded by net work of thick wooden trusses and beams. The building is large and would give ample room for repair tools and pits if the greater portion of it was not monopolized by a transfer table. A transfer table inside a repair shop is about as great a failure as a turn table is inside a roundhouse. Theoretically, both of these things are just what is correct but in practice they do not answer.

Mr. Griffith is doing lots of work in the shop considering the limited means at his command, and the rolling stock on his division looks remarkably well. There is very bad feed water on the division and the boiler repairs are naturally heavy. He is double riveting the mud rings of fire boxes at the corners, and he finds that the practice works very satisfactorily in preventing leakage. As many of the fire boxes are above the frames leaky mud rings prove expensive. They have a fairly good car shop and excellent repair yards. They were doing a heavy business in repairs, but no new work was under way.

Seams in Wheel Fillets.

While visiting Master Mechanic Griffith at the Delaware, Lackawanna & Western Buffalo shops lately we were given a good object lesson on a dangerous weakness of cast-iron wheels. There were in the shops' track many cast-iron wheels that had been removed from cars, but remained on the axles. In looking over these wheels the rules applying to the defects of wheels came up, and we were disposed to argue that they were unnecessarily strict. Mr. Griffith had a different opinion, and held that for some defects the rules could not be too strict. He said that although we hear very little about seams in the fillet, it is a very dangerous defect. He looked over some of the old wheels on the track, and, pointing to a slightly seamed fillet, he said: "You would not consider that wheel dangerous to run?" We readily expressed the belief that there was nothing the matter with the wheel that was likely to curtail its durability or detract from its safety. A car repairer was directed to strike the flange a blow with a ten-pound hammer, and it broke off at the first stroke. The seam was the outside indication of a flaw about ¼ inch deep following the fillet. Several other wheels were found with the same defect, and every one broke at the first blow. We then agreed that a special rule applying to seams in fillet would be in order.

IN THE KRUPP STEEL WORKS.

Editorial Correspondence.

The portion of Rhenish Prussia which we go through on our way from Brussels to Dusseldorf is a fertile, highly cultivated agricultural country. As we proceed northward traces of coal mining become conspicuous, but still the principal feature of the landscape is good farm land. Beyond Dusseldorf chimneys and other signs of busy manufacturing life become more prominent than the ruins of castles and towers of ancient churches that the American traveler has an abnormally keen eye for; railway junctions and crossings become numerous, long sidings are full of cars containing coal, and ore, and finished iron products, and before we realize it we are in the heart of the German black country. A pleasant thing about this region of mining and manufactures is the prevailing air of cleanliness and neatness. The black manufactures have not made the country smutty, filthy and squalid as they generally do. The furnaces, ovens and smelters have left the trees green and the fields unsoiled.

Passing through a country of increasing ruggedness that resembles the scenery in some parts of middle New York, from curves on the steep ascending track we catch glimpses of a city that looks a small forest of chimneys. On pulling up with a jerk worthy of a cable car at the modest station we hear the cry of Essen, and know that we are at the end of our journey. From the hilltop Essen looks like one large factory, and that factory is the Krupp Steel Works. No baron of the olden time was a greater man in all Germany than the Krupp family has been in Essen and in all Prussia, and they have a good right to be great, for no single family ever did so much for a community in half a century.

On presenting our letters of introduction at the office of the works we were very courteously treated, and a well-informed engineer was assigned to accompany us through the works. There might have been some parts of the establishment that they would have refused to show us; but we did not happen to ask to be shown that portion. Before leaving New York, on shipboard, during our journey, and even at our hotel in Essen, when people heard that we were going to see the Krupp Steel Works, they invariably exclaimed "They will not show you anything." The idea that we would be permitted to see the fabrication of guns was asserted to be preposterous. Remembering all these discouraging remarks, my modest companion, on being asked what he would like to see first, promptly replied, "the making of guns." There was no demur. We were led cheerfully along to the ordnance department, and were shown small guns and big guns in all stages of manufacture, from the rough ingot to the finished cannon with all its elaborate mechanism ready for beginning its work of destruction. Some of the boring and rifling appliances were very ingenious; but a description would hardly be interesting to our readers. Guns weighing 120 tons have been made in these works, but the heaviest ones which we saw were 100 tons. These immense engines of war had the barrel about 40 feet long and four feet diameter at the breech. The ponderous tube which forms the core of the gun is, like all the other parts, made of the best crucible steel. The ingot from which this tube for the largest guns was forged is said to have weighed over 77 tons. It took the contents of 1,800 crucibles to cast the ingot. A mechanic can readily conceive the vast amount of work called for to roll and forge this ingot into the form of a shaft, then bore and turn away about half the material. After this is done, two sets of huge concentric rings have to be shrunk on the tube, and again the latter has to be bored out to overcome the distortion caused by the shrinking process.

The machine work produced is admirable, whether it be the minute work on fine dies or the accurate fabrication of massive machine-gun mechanism; but the tools with which the work is done have no striking merit. The heavy tools are particularly heavy, and are sufficiently stiff to insure accuracy; but heavy and light tools were alike deficient in minor conveniences that American manufacturers regard as being necessary to facilitate production. The magnitude of the works, and the ponderous nature of the operations that appeared on every hand, were profoundly impressive; but we could not help noticing that the high character of the productions was due more to personal skill and persistent manipulation than to highly perfected or ingenious mechanism.

Although there was little of what Americans, with their genius for specialties, would call perfect tools, there were everywhere evidences of a perfect system of carrying on operations. The arrangements were such that the work always kept moving onward without any retrograde movements. The big forgings or castings started from certain points, and every successive furnace, pit, tool or machine they visited brought them one step nearer the finished goal. Thus, the big guns, that are like magnets to our attention, are turned in one shop, then they pass to another to be bored, further on the rifle grooves are cut, and then they are taken to a point where the breech mechanism is fitted, and in every move they are following a course that keeps them clear of other work.

I have written about the gun manufacture first, because that was the first place we visited; but it was by no means the department that excited our greatest interest, attention, and curiosity. While yet in the gun department we had been shown mild steel castings of extremely intricate form that machined as clear from blow holes as any forging. We were very desirous of learning how the casting was performed that produced such compact metal. In the same open-hearth department was the material produced for the axles, wheels, boiler-plates, and other railroad stock in which we were particularly interested. To that department we went, we saw, and we did not conquer. The excellence of the Krupp product that finds its way into railroad rolling stock is admitted. We expected to learn something about how the superiority is obtained. We stood round and watched them pouring all kinds of steel castings. We saw the successive operations that tires go through on the way from the ingot to the tire ready for going on the wheel. We paid close attention to the manufacture of wheels and axles. We had seen similar operations in American metallurgical works, and we could not perceive any marked difference, except that most American steel works appear to have better plant and more business-like machinery than they have at Krupp's. There are no doubt forces at work emanating from knowledge and skill that are not apparent. Manipulation was very persistent in every stage of the work. Visitors are not likely to carry away any of the secrets of steel making or of any other occult arts practiced at Essen. The only peculiarity that could be noticed about the castings was that the pouring gate was particularly large.

The open-hearth plant is very large, and is arranged well. There are two long rows of Siemens-Martin reverberatory furnaces facing each other, with a casting pit floor between them. Here there are fairly good facilities for handling the flasks, molds and material, and good means of transport are provided for taking the castings to the points where succeeding work upon them is done.

In some places a plant like the open-hearth or the Bessemer that are in Krupp's would be considered something worth showing; but here the cast-steel business appears to overshadow all other departments. This is natural, for the cast-steel product has made the works famous. An interesting part to us was the pouring of crucible cast steel ingots from which railway tires are rolled. This is an important section of the works, but the visitor can learn nothing of the secrets of mixing that gives the steel the wonderful combination of great tensile strength combined with ductility. The operations appear in no way different from other works where cast steel is made.

DISCOVERY OF CAST STEEL.

In the history of the world there have been many romances entwined with metallurgical advances and discoveries. The connection of the Krupp family with the development of the cast-steel industry, although entirely modern, presents many heroic characteristics.

The iron industry of Germany had made some progress in the time of Christ, for Agricola, the Roman general, described iron smelting works of Saxony as seen about the middle of the first century. The business appears to have extended to other parts of Germany, and that country continued to be the principal seat of the iron trade till about the beginning of the eighteenth century. As late as 1750 all steel used in Sheffield for the manufacture of cutlery was imported from Germany. It was blistered steel, the best steel then produced. About that time Benjamin Huntsman, an English watchmaker of German extraction, discovered the art of making cast steel. When the merit of this steel forced itself upon the unwilling minds of English tool and cutlery makers, the demand for the German steel was cut off. The method of making cast steel discovered by Huntsman was long kept a secret, and by this means for about half a century England retained a monopoly of cast steel making.

In 1810 Friederich Krupp, a lineal descendant of a line of metal workers, rented a small water-driven forging plant near Essen. The glory of German steel making had become little more than a reminiscence; but this son of a race of artisans had pride in his craft, and believed that what others had done in steel working he could accomplish. The Franco-English war had cut off the supply of cast steel from Continental Europe, and it was greatly in demand for cutting tools and weapons. Although 60 years had elapsed since Huntsman first put cast steel on the market, the secret of its production was still jealously guarded by Englishmen. Friederich Krupp imposed upon himself the task of discovering how to make cast steel, and he pursued the quest with unceasing, tireless energy till success crowned his persistent efforts. But the reward was slow in reaching the zealous experimenter, and worn out by unremitting and unrequited toil, in 1826 he went to a premature grave, but left a son, Alfred, to take up his father's burden and to carry on the work that was merely but begun. This son was a boy only 14 years old, but even at this tender age he had worked for several years in the factory, and had learned the secrets of making cast steel.

This boy and his energetic mother continued to carry on the work so well begun by the father. The boy so early saddled with stupendous responsibilities developed into a great master of the art of steel making, and besides became an unusually capable man of business. Under his able management and fostering care the fame of Krupp steel spread through the world, and the works went on prospering and increasing. The works at Essen are now the largest in the world, and no establishment has a higher name for the excellence of the productions. The personal equation is supreme in these works; the genius that insures success is made up of extreme careful ness and matchless skill begotten of adaptability combined with developed dexterity. The firm do their work through men, not through machinery.

Yet there appears to be no lack of machinery. There are over 20,000 people employed in the works, and their productive powers are aided by 1,700 machine tools, and 90 steam hammers. One of the latter is of 50 tons capacity and its blows acted like small earthquakes, that could be felt two miles away. Power is supplied by 455 steam engines transmitting about 20,000 H. P., steam being generated by 442 boilers. There are 1,545 furnaces and 21 trains of rolls in the different mills. The works spread over 1,000 acres of ground, and the roofed buildings cover more than 200 acres, more than three times the whole of the space occupied by the Philadelphia Centennial exhibition. The grounds are said to be traversed by 27 miles of standard-gauge track which is worked by 16 locomotives and 550 cars. The works are producing about 300,000 tons annually, which includes crucible, open-hearth and Bessemer steel, and homogeneous wrought iron.

No man has ever built for himself a monument like that raised by Alfred Krupp in developing the steel industry of Essen. His mantle in turn has fallen upon a second Friedrich Krupp, who inherits the family ability. Although the works produce many warlike weapons, the establishment is a stupendous triumph of peaceful pursuits, a glorious manifestation of the victory that belongs to successful industry.

A. S.

Schenectady Locomotive Works.

The Schenectady Locomotive Works are at present turning out a little more than four new locomotives a week, most of them being very heavy engines. Out of 220 locomotives built by the works last year, there were 21 consolidations, 58 moguls, 29 ten-wheelers and 36 six-wheel switching engines. By these figures it will be seen that the 8-wheel locomotive is losing its right to be called par excellence the "American" engine. Among the engines lately built or in course of construction, are six 10-wheel passenger engines for the Illinois Central weighing 60 tons. This company have lately received 14 mogul freight engines with cylinders 18 × 24 inches. There are in the shops part of a group of 20 consolidations for the Chesapeake & Ohio, with cylinders 21 × 24 inches and Belpaire fire boxes. These engines weigh 65 tons. A compound locomotive has recently been built at the works which is substantially the same class of engine as the 20 × 24 inch ten-wheelers that have lately been built for heavy passenger service on the Michigan Central Railway. The only difference made in compounding is the putting in a cylinder on one side, 29 inches diameter, and the attachments necessary for regulating the distribution of steam from one cylinder to the other. The engine made several trips on the New York Central and worked very satisfactorily. She is now at work on the Michigan Central. We expect to publish full particulars about the construction and performance of this engine next month.

During a brief visit to these works we noted a peculiarity of tool arrangement which struck us very favorably. Instead of grouping tools of a certain kind together, such as planers, lathes, etc., they put in convenient form all the tools that are required for finishing certain work. Thus the rough castings of cylinders are all brought to one section, and there are the boring tools, planers, milling machines, drills, etc., that do the work of finishing a cylinder. Frames and other parts are managed in a similar way. A part of the engine has to be moved but a very short distance before it is finished ready to go to the erecting shop. They have lately added a variety of special tools to the works, among which we noted a large Bement & Miles planer, a Brown & Sharpe milling machine, and several Pratt & Whitney drop hammers. They are rapidly extending the work done by drop hammers, and are doing a great variety of forging by the aid of formers.

Signals and Signaling.

At the December meeting of the New England Railroad Club a large and highly attentive audience assembled to hear Mr. R. H. Soule, of the Union Switch and Signal Company, deliver an address on Signals and Signaling. Mr. Soule gave particulars of the history of signaling and the development of what are now acknowledged to be the only safe method of signaling trains on crowded railroads. The advantages and disadvantages of the different forms of visible signals were discussed and the conclusion was arrived at that the best form of signal is the semaphore with the arm of the home signal painted red, and that of the distant signal green. The various methods, mechanisms and powers for operating signals were lucidly described. The paper gave a highly interesting description of interlocking, with details of the most successful mechanism and rules that were necessary for the guidance of those who designed signal plants.

The paper was so long that we cannot find room for it entire, and it is one of those productions that cannot be abridged with justice to the author or the reader. It forms decidedly the best treatise on signals and signaling that we have ever read, and we advise our readers who are interested in the subject or who desire to learn about it to apply to the Union Switch and Signal Company, Pittsburgh, for a copy of the paper.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Fifth Paper.

STARTING POWER OF TWO-CYLINDER COMPOUND LOCOMOTIVES.—So much has been written on this subject, and so little has been really logically demonstrated, that it may be well to first briefly investigate the starting power of locomotives of the ordinary form in order to compare the two systems intelligently.

It is the almost universal practice to measure the tractive power of locomotives by applying the formula, $T = \frac{d^2\, p\, s}{D}$ in which d = the diameter of the cylinders in inches, p = the mean effective pressure in pounds per square inch, s = the stroke in inches, D = the diameter of the driving wheels in inches, and T = the tractive power or pull at the rail in pounds. This formula is based upon the fact, that, neglecting friction, the work done in both cylinders during any period, such as one revolution, is equal to that done at the circumference of the driving wheels during the same time. The work done in the cylinders in inch-pounds is 2 × area in square inches × mean effective pressure × twice the stroke in inches $= 2 \times \frac{1}{4}\, \pi\, d^2 \times p \times 2\, s.$; that at the rim of the driving wheels is the pull in pounds × the circumference of the wheel in inches $= T \times \pi\, D$; therefore,

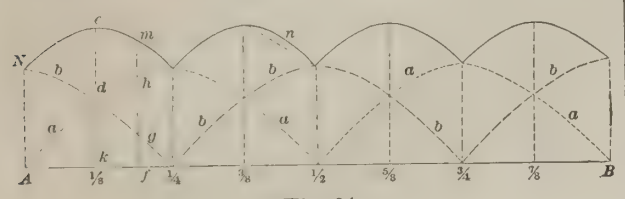

Fig. 24

$$T = \frac{2 \times \frac{1}{4}\, \pi\, d^2 \times p \times 2\, s}{\pi\, D} = \frac{d^2\, p\, s}{D}.$$

It follows from the method of deduction that this formula gives an *average* value for the pulling power, and therefore that, while it furnishes a ready method of comparing the pulling power of locomotives under ordinary conditions, it is of very little use in estimating the starting power, since the *minimum* pull, and not the *average*, is then the measure of the power of the locomotive.

In the ordinary locomotives, assuming that steam can be admitted during the full stroke, and neglecting the effect of angularity of connecting rods, the minimum pull occurs when one crank is on the half center, the other being at a dead point, and the maximum pull is developed when both cranks make an angle of 45 degrees with the center line through the dead points. This can be readily demonstrated by calculation, or by a graphical construction. There are several methods of representing rotative efforts graphically, one of which is shown by Fig. 24, in which the dotted line $a\ .\ .\ a$ represents the rotative effort, or the tangential pull or push, on one crank pin, and $b\ .\ .\ b$ is that of the other at right angles to it, the steam pressure being assumed as constant throughout the stroke. The method of construction is as follows: Let $A\ B$ be the length of the circumference of a circle, of which $C\ D$, Fig. 25, is the radius. It can be readily shown that the component $D\ F$, of the pressure on the piston $D\ H$, which tends to produce rotation, is proportional to the sine of the angle a, through which the crank has turned from a dead point. Divide the line $A\ B$ and the circumference in Fig. 25 into the same number of equal parts. Then through the points of division on $A\ B$ lay off perpendicular distances, such as $k\,d$, equal to the lines which represent the sines of the angles in Fig. 25, such as $K\ D$.

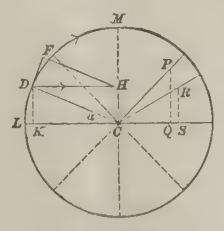

Fig. 25

The dotted curve $a\ a$ represents the variations in rotative efforts on the crank starting from $C\ L$ during one revolution, and the curve $b\ b$, shown by a broken line, represents the variations in efforts on the crank starting at $C\ M$, or at right angles with the first. The total rotative effort is shown by the ordinates of the full line curve in Fig. 24, which is obtained by adding the ordinates of the curves for the single crank, for example, $f\ m = f\ g + f\ h$. It is evident that the value of the total effort varies between $A\ N$ and $k\ e$. In the first case, one crank is on a dead point, and the other is on the half center, or midway between the two dead points. The pull at the rail is then $\frac{1}{4}\, \pi\, d^2 \times p \times s \div D$, which is .7854 of the tractive power as found by the ordinary formula. In the second case the pull is twice that of one crank when making an angle of 45 degrees with the center line, or it is $\frac{1}{4}\, \pi\, d^2 \times p \times 2 \times .707 s \div D$, which is 1.11 of the tractive power as usually estimated. It is also clear that there are four maximum and four minimum points during a revolution. These values are determined, as has been said, on the basis that a constant steam pressure can be maintained throughout the stroke, which would be the case in starting if steam could be admitted to the cylinder during the whole stroke. But when the latest cut-off takes place, when the piston is some distance from the end of the stroke, as, for example, at 21 inches with 24 inches stroke, the engine may be in a worse position for starting than that given above as a minimum. When one piston is 21 inches from the beginning of its stroke the other will be about four inches from the beginning of its stroke, and its crank will have turned through about 50 degrees from a dead point. If cut-off takes place at 21 inches, no steam can be admitted to that cylinder during the remainder of the stroke, and the work of starting devolves upon the other cylinder. When the piston has moved four inches from the beginning of the stroke the rotative effort is about three-fourths of the maximum for one cylinder, and is, therefore, about .589 of the tractive power as usually estimated. This corresponds to an ordinate of the curve $a\ a$, a little to the right of $k\ d$, and is evidently the most difficult position from which to start the ordinary locomotive. The reduction in the rotative effort on account of the fall in pressure due to the expansion after cut-off and release will be slight. It can be shown on the diagram by laying off radial distances such as $C\ P$ and $C\ R$ on the proper radii to represent the pressures for these crank positions, and using the lines $P\ Q$ and $R\ S$ for ordinates in Fig. 24 instead of those used before. The final effect is shown by the dotted curve at n, Fig. 24.

As the locomotive starts the mean effective pressure in the cylinders will be somewhat reduced, but the reduction will not be of large amount within what may be called the starting limits, or until the link would ordinarily be hooked up. As the speed increases the inertia of the reciprocating parts, etc., will be sufficient to modify the form of the diagram of crank efforts, but it is not necessary to consider that in estimating the starting power.

Turning now to the compound locomotive, it is apparent that in the Mallet system the starting conditions are almost identical with those in the simple locomotive. If the h. p. cylinder is of the same size as one cylinder of the simple locomotive, and the cylinder ratio is two, it is only necessary to admit steam of one-half the boiler pressure to the l. p. cylinder in order to have starting power equivalent to that of the simple engine, the same boiler pressure being used. If the l. p. initial pressure is greater than one-half the boiler pressure, the starting power of the compound will be greater than that of the simple engine in all positions in which the l. p. cylinder is available for use in starting, that is, except when the l. p. crank is on a dead point, or when the l. p. valve is in such a position that steam cannot be admitted. If the boiler pressure of the compound is higher than that of the simple engine, and the h. p. cylinder is the same size as one of those of the simple engine, the starting power of the compound engine will be the greater in about the proportion of the two boiler pressures.

In the Worsdell and von Borries type of compound locomotive the conditions in starting are quite different from those just described. When steam is admitted to the receiver by means of the starting valve, the intercepting valve is closed, and the h. p. piston therefore starts against the pressure of the steam or air which filled the receiver just before the starting valve was opened. The amount of this receiver pressure will depend upon the length of time during which the engine has been standing, the condition of valves, etc. If at starting the h. p. crank is at a dead point, the pencil of an indicator, which is applied to the steam end of the h. p. cylinder during the first stroke, will trace a line similar to $a\ b\ c$, Fig. 26. The

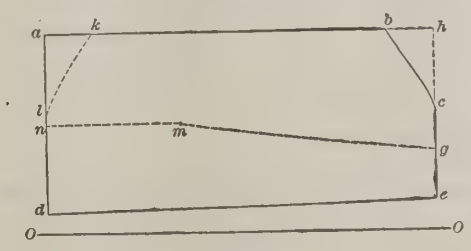

Fig. 26

back pressure acting against the other side of the piston during this stroke is shown by a line such as $d\ e$, the pressure at e being somewhat greater than that at d on account of the compression in the h. p. cylinder and receiver. The initial back pressure is assumed in the present case as equal to the atmospheric pressure. The diagram, $a\ b\ c\ e\ d$, thus represents what may be called the effective indicator card for the first stroke of the h. p. piston.

When the h. p. exhaust opens the pressure in that cylinder and the receiver will fall to some point g, which can be only approximately determined by calculation. It is located on Fig. 26, by calculation on the basis of no condensation or evaporation during the exhaust. The forward pressure on the h. p. piston during the second stroke will be similar to that during the first stroke, and is shown in Fig. 26 by $h\ k\ l$. The back-pressure line during this stroke will consist of, first, a curve $g\ \ m$, which represents the compression by the h. p. piston of the steam which fills the space between the h. p. piston and the intercepting valve, until that valve opens; and second, of a line $m\ n$, of nearly constant pressure, which represents the back pressure during the remainder of the stroke, after the intercepting valve opens and the starting valve is closed. It is generally stated that the pressure of the steam, which is admitted directly to the receiver in starting is reduced by wire drawing to about one-half the boiler pressure. Assuming this to be correct, the h. p. back pressure will become sufficient to open the intercepting valve when about five-eighths of the second stroke has been accomplished, as indicated at m, Fig. 26. The net diagram from which the effective pressure on the h. p. piston for the second stroke can be obtained is then $h\ k\ l\ n\ m\ g$. A diagram of rotative efforts constructed from these indicator cards is shown in Fig. 27 by the curve $A\ E\ C\ F\ B$, from which the reduced effort resulting from the increasing back pressure during the second stroke is apparent.

The distribution of work in the l. p. cylinder in starting does not differ from that in the simple engine. The rotative effort will, therefore, be represented by a curve such as $H\ K\ L\ D\ M$, Fig. 27, which has the same form as the

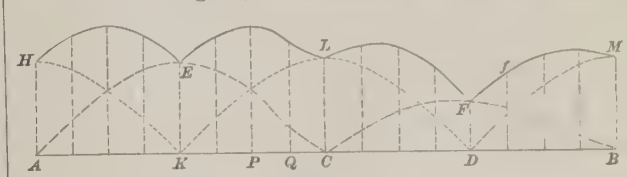

Fig. 27

single crank curves in Fig. 24. The curve in Fig. 27 is constructed on the basis of the initial l. p. pressure, being one-half of the boiler pressure. If the initial pressure is greater than this, the ordinates of the curve between H and K, K and D, etc., should be proportionately increased. The combined effort of the two cylinders is shown in Fig. 27 by the full line curve. The intercepting valve opens at about the point f, and from that point the engine will work as a compound. It has been already shown that when so working with the customary pressures the power developed at late cut-offs is less than that of the simple engine. The location of the point at which the intercepting valve opens depends upon the pressure in the receiver before starting, the pressure of the steam admitted to the receiver by means of the starting valve, and the size and location of the receiver. For any given combination of conditions it will be found at a definite distance from the point C, or from the end of the first stroke of the h. p. piston. In the present case this point was found to be about five-eighths of the stroke from C. It is obvious that this action is not at all dependent upon the first stroke of the h. p. piston, but only upon the exhaust from that cylinder. It follows from these considerations that, if the h. p. crank is at a dead point at starting, the engine will move through something over three-fourths of a revolution before compound working begins; but, on the other hand, if the h. p. piston is at the position corresponding to P, or near the point at which cut-off takes place, the compound working will begin after about seven-sixteenths of a revolution. If the h. p. crank is in some position such as Q, at which the steam valve is closed, the starting must be accomplished by the l. p. cylinder alone; but after a slight movement, sufficient to carry the h. p. crank over the dead point, the cycle will continue as if started at A, the effect being to prolong the time of direct working of the l. p. cylinder to about seven-eighths of a revolution.

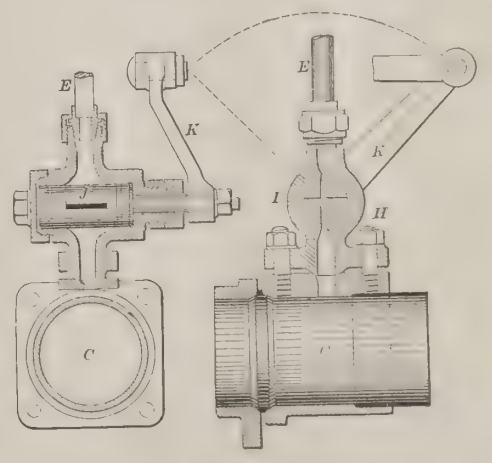

Fig. 28

After compound working commences, and while admitting steam for as much of the stroke as possible, the combined diagram of rotative efforts would be similar to Fig. 24, but with a smaller mean effective pressure, the proportion being with boiler pressures of 170 and 150 pounds in the two types, not greater than 110 to 122, as has been already mentioned. The two diagrams Figs. 24 and 27 are not drawn to the same scale of pressures, but the shape of the full line curves represents with reasonable accuracy the variations in rotative efforts in the simple and compound locomotives. In conclusion, it appears that, with the pressures customary in the two forms, the pulling power of the Worsdell and von Borries' type of compound locomotive in starting may be greater than that of the simple engine having cylinders of the same size as the h. p. cylinder, during the first half revolution approximately, but that after this the power of the compound engine diminishes until it is from eighty to eighty-five per cent. of that of the simple engine.

There is another type of two-cylinder compound locomo-

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tive which has not as yet been described in these pages and for which somewhat different conditions exist in starting. In this form the marine practice is followed of placing a valve or cock on the receiver, by which steam from the boiler can be admitted to the receiver and the l. p. steam chest, without the addition of intercepting valves or other complications. This arrangement was applied to a two-cylinder compound locomotive in India by Mr. E. W. McK. Hughes, in 1882, and is in use in Germany in a modified form known as the Lindner starting valve. The latter is illustrated by Fig. 28, which is reproduced from the *Railroad Gazette*. In Fig. 28, *C* is the receiver, *E* is a small pipe connecting the receiver and the main steam pipe, and *J* is the starting valve, which has two ports, *H* and *I*, formed in it at right angles. The lever *K* by which the valve is operated is connected to the reach rod, and the proportions are such that *K* turns through ninety degrees, as indicated in the figure when the reverse lever is moved from one extreme position to the other. The effect is that steam from the boiler is admitted to the receiver when the valve motion is in either the extreme forward gear or the extreme backward gear, and that the cock is closed for intermediate positions. Another feature of the Lindner system is the introduction of two small ports, each having an area of about 0.17 square inch, in the high pressure slide valve, which are so located that when the valve covers the steam port, as after cut-off takes place, that end of the cylinder is connected by means of one of these small ports with the exhaust side of the valve and thus with the receiver. The effect is to admit steam at low pressure to the end of the h. p. cylinder, which is covered by the slide valve, and as the other end is then open to the exhaust and hence to the receiver pressure, the pressure on the two sides of the h. p. piston is partially equalized. In other words, the effective back pressure on the h. p. piston is more or less reduced, so that it offers little resistance in starting. This device is, of course, useful in starting only for the piston positions between full gear cut-off and the end of the stroke.

The possible effect of this arrangement of starting gear will depend upon whether or not a safety valve is provided to limit the maximum pressure in the receiver. If this receiver pressure is equal to one-third of the boiler pressure, with a cylinder ratio of two, the effect of the starting valve is to enable the engine to start with very nearly the same distribution of pressures on the pistons as would be found when it is working as a compound in full gear. The resulting rotative efforts will then be represented by a curve such as the full line curve in Fig. 24, the ordinates or actual pressures, however, being less than those for the simple engine in about the proportion of 113 to 150, with boiler pressures of 170 and 150 pounds.

If the receiver pressure is allowed to become higher than one-third the boiler pressure, the back pressure on the h. p. piston is increased proportionately, and the result is that the power of the h. p. cylinder is reduced, while that of the l. p. cylinder is increased. The advisability of using the higher pressure depends upon the positions of the cranks at starting. If the l. p. crank is at a dead point, the maximum effort will be obtained by not admitting any steam to the receiver at the instant of starting, but before the engine has made one-eighth of a revolution pressure in the receiver will be necessary to enable the l. p. piston to act. The other extreme is when the h.p. crank is at a dead point in starting. When this is the case, the l. p. crank being then on the half center, full boiler pressure could be advantageously used in the l. p. cylinder, with the result of obtaining a rotative effort about four times as great as in a simple engine starting with the same crank positions. But similarly to the first case, the receiver pressure should be reduced almost as soon as the engine begins to move, or else the h. p. piston will be practically thrown out of action, and the engine might be stalled after making one-fourth of a revolution.

It appears, then, that with this starting valve and a properly loaded safety valve the starting is very simple; but the power is less than that of the simple engine having cylinders of the same size as the h. p. cylinder of the compound, the boiler pressures being 170 and 150 pounds, respectively. With no safety valve, the utility of the device depends upon the position of the crank and the judgment of the engineman, and to this it should be added that the l. p. cylinder, piston, rods, etc., must be made strong enough to bear the full boiler pressure.

It is evident that each of the several types of starting arrangements has decided advantages and disadvantages. With the Mallet type considerable complication seems unavoidable, but the cylinders can be proportioned for the usual work on the road, and the engine will nevertheless be very powerful in starting. With the Worsdell and von Borries type there is also complication, and the engine if proportioned as above will be powerful at the start, but the power rapidly decreases. The Lindner type has the advantage of great simplicity, but the cylinders must be considerably larger than for a Mallet engine of equal starting power.

CONDENSATION IN CYLINDERS.—It is not intended to discuss under this heading the effects of initial condensation and re-evaporation during expansion and during exhaust, but rather to call attention to some of the special requirements of the compound locomotive in this connection. It has been repeatedly shown by writers on compound engines that the loss from condensation should be less in the compound than in the simple engine, under similar conditions, but the gain in this direction may be more than overcome by faulty mechanical arrangement. That is to say, if the cylinders, steam passages and receiver are poorly protected from losses by radiation, the loss by condensation may become sufficiently great to seriously diminish the theoretical thermal advantages of the compound engine.

When steam which is initially dry is expanded in a *non-conducting* cylinder, or without gain or loss of heat, a partial condensation takes place, and the greater the range of pressure is during expansion, the greater will be the condensation. As the transfer of heat between the steam and the cylinder walls is less in the compound than in the simple engine, the conditions in the compound are more nearly those of non-conducting cylinders, while the ratio of expansion is greater, and hence a greater amount of condensation during expansion might be expected. Therefore, if the initial steam is dry in both cases, we would expect to find more moisture in the l. p. cylinder of the compound at the end of the expansion than in the simple engine. This is by no means a complete statement of the case, and is only intended to indicate why the presence of considerable moisture in the exhaust from a compound locomotive is not necessarily evidence of uneconomical working.

In discussing this subject, Mr. von Borries has written substantially as follows: "Since in compound engines re-evaporation is very much lessened—one of the advantages of the system—the steam in the cylinders is always more moist than usual, and in the large cylinder always condenses to some extent. In order that the water may not have an opportunity to re-evaporate, it should be removed. This is most readily accomplished by cutting notches about 2 millimeters (0.08 inch) in width in the cylinder cocks with a sharp-edged file; by this means the cocks are kept sufficiently open to allow the water to escape." "The steam escaping from the stack is always wet; this, however, attends the system, and is no sign of priming, but of the fact that much heat has been withdrawn and converted into work."

In some designs of compound locomotives "safety valves," or, more properly, automatic water valves, are fitted to the l. p. cylinder to prevent damage by possible accumulation of water. This is, however, good practice for all large steam cylinders.

The above remarks simply emphasize the statement already made as to the advisability of carefully lagging the cylinders, and of enclosing the receiver in the smoke-box in order that the steam delivered to the l. p. cylinder may be as dry as possible.

A Hint to Tool Builders.

One of the most successful machine designers, if success be viewed from the standpoint of satisfaction to the customer, whom we have ever met was a young man who received all of his mechanical training in the locomotive repair shops and "bone-yard" of a railroad. He claimed that the experience gained in these two places was invaluable to him, and that he had there learned to look upon machine designing as something more than the mere building of a tool that would work and be well adapted to its purpose—it should be readily accessible for repairs.

He had seen so many locomotives and cars built solely with a view to economy in first cost, and without the slightest thought of future repairs, that in every machine which he designed he always asked himself the question: "How can I mend it?" The answering of this question often added to the cost of the machine, yet invariably saved in the cost of maintenance. Still, as the machine had to be bought but once, and kept in repair for years, there was no comparison in the importance of the two. A tool that is easily get-at-able will always be a popular one in the shop.

It is in just this particular that many tool builders fail. They are well up in the strength of parts; they know just how to proportion and accomplish the work required; they finish to a nicety, and no fault can be found with the new tool; but they are builders—builders of new tools, not repairers of old ones. The machine is set up with never a thought of the poor fellow who must take it apart to mend.

We recently had the pleasure of visiting a shop that had been newly equipped with special tools from one of the best known and most reliable builders in the country. The superintendent was very proud of the fine condition and workmanship of his machinery. He said that it was a perfect pleasure to set it up; that every piece fitted to its place like the glove on a lady's hand, and he paid the highest compliments to the designer for the care bestowed upon it.

"But," he added, half to himself, "he doesn't always seem to think about repairs."

"How is that?" we asked.

"Well, take that hydraulic wheel press, for instance. It is a jewel; but they have, unfortunately, made the angle of seat of the suction valve 67 degrees, and this is so sharp that we are continually troubled by its sticking. Now, when it once sticks, it's stuck. No amount of hammering and tapping on the shell will budge it. The only thing to do is to take it out."

"Isn't that easily done?"

"No. They have put the pump so low, and placed the outlet pipe so near the suction, that the wrenches won't take hold of the nuts. If the outlet pipe had been moved back three-quarters of an inch and the pump raised an inch and a half, we could take out the valve in five minutes, whereas it now takes half an hour. No more brass would have been used, and the valve would have been accessible.

"Then take this drill made by the same concern. They have put a left-handed worm on the feed-gear, which necessitates the crossing of the feed belt. As the distance between the spindle and the feed-cone centers is not more than eight or ten inches, that belt gives no end of trouble, for it is almost impossible to get a lacing that will not tear out. If they had only made the worm right-handed, the belt would be open and we would be happy.

"But when it comes to repairs, just deliver me from that wheel borer. It is a splendid machine, except for that; but they have put such a tangled mass of worms and gears on the feed spindle that it takes an hour to get it out. For example, the nest of gears that drives the feed is on a spindle bolted to the body of the machine. Next the gears, and keyed to the same sleeve with them, is the belt pulley. The only means of oiling this sleeve is through an oil-hole in the pulley at one end. As the sleeve is some ten inches long, the oil-way along the bottom of the spindle is easily clogged. Now, notice that the larger gear, on this otherwise easily removable sleeve, is on the inside, so that the nest below on the feed spindle must come off first; but these are slipped over the spindle from the other end and held by a collar rigid with the shaft, so that the whole shaft must come out. Here we find that the oil-drips under the worms on this shaft are so large that they strike the worm gears as the shaft is drawn back, so these worm gears must come off first. Consequently, we must tear the machine to pieces in order to remove a nest of gears that would come off without the slightest difficulty if it were turned around end for end, and there is no good reason why this should not be done."

There is no doubt but that criticisms of this kind would be invaluable in their suggestiveness to any tool-builder, for it is the man who runs a machine and has to keep it in repair that is familiar with its good and bad points. Therefore, if, from a business standpoint, a business house finds it important to pay regular and systematic visits to its customers, why should it not be equally desirable that machine designers should visit their working tools and get points upon their merits. If this were done to a greater extent, there is no doubt but that the tools built would be more readily repaired than most of those that are now upon the market.

Rules for Interchange.

The following notice has been issued: The Central Railway Club are discussing the code of rules for the interchange of cars. Their recommendations are to be formulated and presented to the revision committee of the M. C. B. Association previous to the next annual meeting. At the last meeting of the club rules 1, 2 and 3 were dealt with. A committee consisting of Messrs. McIlwain, Macbeth, Lentz, Smith and Schrimpton were appointed to report on rules 4 to 9, inclusive, to be discussed at the January meeting. To better enable this committee to make an intelligent report they particularly desire that railway men interested in the interchange of cars will give them their views relating to the rules mentioned. Any communications thereon addressed to the chairman of the committee will be appreciated. Address

J. D. McILWAIN,
Grand Trunk Railway,
London, Ont.

Grade Crossings.

The Railroad Commissioners of Illinois have rendered a decision permitting the Chicago & Calumet Terminal Company to cross the tracks of the Chicago, Burlington & Quincy at grade in a most dangerous place just outside the yards of the latter company near Chicago. The policy followed by the most efficient railroad commissioners of late years has been to refuse to consent to railroads crossing each other at grade unless under very exceptional circumstances. The Illinois Railroad Commissioners have been noted for years as the least practicable of any similar board in the country, but they have gone a little beyond themselves in the stupidity of this decision on grade crossings. Chicago is surrounded by a network of railroads crossing each other at grade that is dangerous to the people having to travel there and the cause of excessive and increasing delays in the movement of trains. Sensible railroad commissions would strive to encourage an improvement on the existing condition of things by doing all in their power to induce railroad companies to cross above or below; but the imbecile officials appointed to supervise railroad interests in the State of Illinois do all in their power to perpetuate an evil which is a constant menace to the lives and limbs of the citizens. The Chicago, Burlington & Quincy railroad company ought to follow a plan adopted by the Central of New Jersey to prevent another road from crossing at grade. Having a double track, they raised one line of the rails about a foot higher than the other at the place where the crossing was to be made.

Purification of Feed Water.

At the December meeting of the Northwestern Railway Club several papers were read on methods of removing from feed water the impurities that lead to the destruction of boiler plate.

Mr. J. O. Pattee, master mechanic of the St. Paul, Minneapolis & Manitoba, read the first paper. He made out an exceedingly strong charge against the impurities found dissolved in water, and attributed to their injurious influence great loss to railroad companies. The claim was made that on Northwestern railroads at least 75 per cent. of the cost of boiler repairs was due to the incrustation and corrosion resulting from foreign substances in feed water. The effect on the sheets of thick scale was described. But according to Mr. Pattee the cost of repairs paled in significance compared with the losses that resulted from loss of heat caused by scale intervening between the heating surfaces and the water. Believed that $\frac{1}{8}$ inch solid scale causes a loss of 20 per cent. of the heat generated, and that the loss increases in rapid ratio as the thickness of the scale increases. The nature of the various solids formed dissolved in water was discussed, and their effects on boilers explained. The injurious nature of an impurity depended on its chemical nature. For instance, water might contain 50 grains per gallon of sodium chloride (common salt) and be used successfully in feeding boilers, because the impurity could be blown off easily and it did not form scale; but the same quantity of sulphate of lime in water would make it destructive on boilers. Analyses of the most common forms of boiler impurities were given, and their effects when present in feed water described. This was followed by an examination into the sources of water supply, with particulars of the leading peculiarities of the waters from different sources. The water from streams and lakes was declared to be most free from the impurities that form scale, and therefore the most suitable for boiler feeding purposes. The water from wells was shown to be worst, and the deeper they went the worse the water generally was.

The methods for preventing the formation of scale were next discussed. Blowing off at the surface or the base. This has to be done judiciously to prevent waste of heat and intelligently to carry off impurities. Important help can be given by the designer of a boiler in preventing impurities from deposititing on heating surfaces and in the providing of facilities for removing scale forming deposits. Did not favor the use of chemical compounds in boilers. Had tried nearly all kinds and regarded them as worthless. Had tried several appliances for removing the impurities by mechanical means, but had no good to say about them. They removed only a small proportion of the deposits. Favored making analyses of the water at the different sources of supply, and there applying the proper chemicals for precipitating the impurities. Also recommended the construction of reservoirs for storing soft surface water.

Mr. W. T. Reed, Chicago, St. Paul & Kansas City, contributed a paper on the subject. He had found the alkali waters in the prairies of Dakota and Montana the most troublesome when used for boiler purposes. This water induces foaming so badly that many fire boxes are injured through the injectors failing to work on account of the foaming. Pumps should be used with water of this kind. Had tried several water purifiers and did not consider that any of them were satisfactory. His experience with scale dissolvent led him to favor the use of compounds that would act on the water impurity to deposit it into the shape of mud. Among the scale dissolvents he had used with success was crude petroleum. Described the Clark process of softening water used in various British cities. This consists of adding caustic lime to water containing carbonate of lime, resulting in the precipitation of the latter. By this process very hard waters may be made comparatively soft.

Mr. W. McIntosh, Chicago & Northwestern, then gave analyses of a variety of waters. The Mississippi River water at Winona contains 1.25 pounds of incrustating solids per 1,000 gallons. The next station west that we analyzed contained 2.02 pounds to the thousand gallons, or 14.53 grains to the gallon. That is ,the total number of grains of incrustating matter was carbonate of lime, 8; magnesia, 5.48; trace of oxide of iron and aluminum; silica, .70, and trace of alkali chloride. Our water along west as far as Kasson, about 60 or 70 miles from Winona, is about in that same condition. Then we get up on the table land at a water station called Claremont, where we have 22 grains to a gallon, and that contains three pounds of incrustating matter to a thousand gallons. Our next water station is Owatonna, and that furnishes nearly four pounds, and is considered pretty poor water for boiler use; four pounds to a thousand gallons would be nearly 12 pounds to a 3,000 gallon tank, which is a good deal. The total number of grains is 34.70; carbonate of lime, 16.97; magnesia, 9.71; sulphate of lime, 1.40; a trace of iron and aluminum; silica, 99; alkali chloride, 2.85; sulphates, 2.78. The city of Tracy has a well that we had analyzed recently with a view to using it if we could. We found it contains 112.69 grains to a gallon; in other words, 9½ pounds of incrustating matter to a thousand gallons; we are not going to use it. We have the analysis of some artesian wells through Dakota. Huron contains 120 grains to a gallon; 6.28 pounds of incrustating matter to a thousand gallons. The artesian well at Harold contains 102 grains to a gallon, and there is only .52 pounds of that in a thousand gallons; that is, incrustating matter. The well at Highmore, Dakota, contains a total of 103 grains to a gallon, and only .91 of a pound to a thousand gallons of incrustating matter. Others range in that ratio. We have the analysis of the first well that our company put down at Pierre, Dak., and it was a bad one. It contains 178 grains to the gallon; 133 of that was sulphate of soda. It made pretty lively work for the boys.

Mr. Pattee: You found the Missouri River water filtered through the sand very good?

Mr. McIntosh: Yes, sir; we consider it the best water we have got on our division, although I have no analysis of it. I have tried some compounds and never got any good results from them. Possibly with carbonate of lime you might use some compound; if you were using that water altogether that would help considerably, if you commenced to use it when you started out, and cleaned the boiler, and continued its use; but further West, where you have alkali water, I never could get any good results from it. Take a boiler that has been running some time, and has accumulated considerable mud, and put a compound into it, and loosen off the scale, and it will settle down among the flues, and have a tendency to collapse them.

We have used some purifiers—some of the mechanical purifiers for settling this lime and other matter before it goes into the boiler; some places we have had fair success with them. Particularly in the western country, where there is alkali water, the purifier seems to have no particular effect on lime water. The water passes too rapidly through the apparatus, and does not have a long enough journey to settle this matter properly.

Mr. Charles N. Hunt read a paper on the "Purification of Feed Water," in which he reviewed all that had been done by the Railway Master Mechanics' Association and others on the problem of purifying water. He dwelt on the injury to steam boilers caused by impure feed water, and expressed his belief that the true remedy would be found in a mechanical purifier. He described the working of the Field purifier with which he is connected.

Mr. H. A. Towne, who had for years taken an active part on the committees of the Master Mechanics' Association that were appointed to investigate the subject of water purification, spoke at some length. He favored using means to remove the scale-forming ingredients from the feed water. When he was a member of a committee he had recommended the taking of water from streams and other sources of soft-water supply; but in practice he had found that locating water tanks away from stations was dangerous.

Mr. Mat. Ellis, C., St. P., Min. & O.: I have got a Smith feed-water purifier, have had it for 18 months. Last winter we ran it seven months without washing the boiler out, and when we washed it out we only got about a bushel of scale. We used Mississippi water; that is very good water.

Mr. Pattee: Speaking of the Smith purifier, there is no question but that it does a certain amount of the work which it is intended to do. We have six of them in service. By the frequent blowing off of one of the engines we were able to run it seven weeks without washing it out; but at the end of that time, on examination, we found that those solids which make the hard scale, which is most detrimental to the boiler, had formed nearly as fast as they had without the purifier. It had caught the mud and the part of the impurities which had precipitated quickly; but the length of pipe was not sufficient, or in other words the water did not get sufficiently hot while it was in the pipe, to precipitate the impurities in the water, and consequently they passed through into the boiler. It did the work to a certain extent, but it was not quite sufficent to do the work as we wished to have it done.

Mr. McIntosh: I would say in regard to the Smith purifier that the first engine we applied it to on the Dakota Division, No. 20, is running between Redfield and Gettysburg, where the water is very bad. Since putting that on in February, 1888, after the engine had seen six months' service, she has run up to the present time and is still running and there never has been a leak in a flue or a stay bolt in that fire-box since—that is, in Dakota between the Jim River Valley and Missouri, while other engines fully as well equipped, running in other localities, changing from one supply to another, have not done nearly as well. Whether it is because that water contains peculiar ingredients that causes it to work so well on that engine, or some other cause, I have not been able to ascertain yet.

The President: Something must be done in this western country, either by mechanical or chemical means, to improve the condition of waters used, or it will be an immense expense to railroads. It has been an immense expense, and it will continue to be so as the business increases, unless we can find some remedy. While business has been light on the various roads, it does not show up so bad; but now that the business is increasing, the number of trains increasing and the size of engines increasing, and the amount of water used, stopping an engine every 100 or 125 miles to wash it out, taking two or three hours, is an expense not only in regard to the engine but because of the delay in time and in getting over the road. I think the master mechanics ought to encourage the manufacturers of different devices by giving them a good fair trial.

Journals and Journal Bearings.

At the November meeting of the New England Railroad Club, Mr. Adams, of the Boston & Albany, read a paper on journals and journal bearings, in which he dwelt on the shortcomings of the common oil box and the resulting trouble with hot journals. Speaking of the necessity for a remedy, he said: What we need to insure us against hot journals is good stock of all kinds for the purpose, and good mechanism in construction. We certainly need an oil box tighter than our present standard, with its open back and crude dust guard, which is soon worn so that every lateral movement of the axle pumps in a quantity of grit, causing the axle and the brass to wear out long before they should, and fills the waste and oil with an ingredient that absolutely destroys its design. Now there are boxes that are comparatively oil and dust-tight. Why not use them? Possibly the principal objection is the additional cost; but we cannot have a piece of mechanism or a suitable oil box without its costing more than our old standard, with two-thirds of the covers off entirely and open to all the dust stirred up by the wheels, and being pumped into the back end by every lateral movement of the axle.

I believe we ought to have, and I am inclined to think that we shall soon have, a box for our passenger service that is absolutely proof against heating at any speed, but it will cost more money. I also believe we should have a box for freight use that is cheaper and much tighter at the back part of the box, and also the cover fitted properly, so it will fit close and stay where it is placed. Now, I am not a prophet nor the son of a prophet, but I believe the time is not far distant when there will be some kind of an anti-friction bearing adapted to car journals of the roller or ball type, that can be produced at a reasonable cost, and will soon supersede all of our old time bearings, lessening the amount of oil and doing away entirely with waste, and reducing the friction to a very small per cent. of what it is now.

Mr. J. N. Lauder, Old Colony, submitted a statement showing that the remedy for hot boxes and for excessive wear of journals and bearings was an oil box made tight enough to exclude dust and grit. He had experimented with four sets of oil boxes that were constructed with a view to making them dust-proof and oil-tight, and the result was highly satisfactory. The bearings in these boxes had run an average of 912 miles to the ounce of loss. Two of the bearings that had been made in their own shops ran 1,067 miles per ounce of metal lost.

On this subject Mr. F. D. Adams writes us: Mr. Lauder gave us some statistics in regard to the wear of journal brasses, as to the number of miles per ounce of brass worn out, which was quite interesting. I carried a brass into the meeting which I had taken out of a lot of 36 that are now running, as I thought it looked exceeding well, having run 101,532 miles and was not half worn out. It did not occur to me to weigh the brass before the meeting and get the mile age per ounce of wear, so when I came home I weighed the brass and found it had lost 37⅛ ounces, taking the average weight of 200 brasses of the same pattern as the original, which was $17\frac{13}{16}$ pounds each, and this gives about 2,719 miles per ounce worn out.

Joint Inspection of Cars.

At the December meeting of the Western Railway Club, Mr. Peter H. Peck read a paper on the above subject. He said: Chicago has become the largest railroad center of the world, and with the extensive growth of the West and Northwest, the interchange of cars between railroads at this point has grown faster than some of our best informed officials anticipated. The car movement at Chicago has been steadily increasing each year, until it is estimated that the interchange now amounts to between 4,000 and 7,000 cars daily, and I think I am safe in saying that 30 per cent. of these cars are more or less defective—require a defect card in transferring. The limited yard room and tracks we have in the city for this vast business makes the inspection of cars both expensive and deficient, and keeps a large number of cars out of service in busy times when cars are most needed. It also causes extra switching, involving the blocking of side tracks and the delaying of freight, thus causing any amount of trouble to car departments and complaints from our superior officers and patrons.

Mr. Peck proceeded to portray the confusion, expense, delay and annoyance that result from the present system, and recommended a system of joint inspection as a remedy. Joint inspection works well in other cities, and he could not see why it was not extended to Chicago.

Mr. Verbryck did not see any reason why joint inspection could not be worked as successfully in Chicago as it was in Kansas City.

Mr. Schroyer did not think joint inspection could be carried out satisfactorily in the Chicago yards. He gave particulars of a red card system which prevents many delays with their cars.

Meeting of Brake-Shoe Metal Committee.

A meeting of the Master Car Builders' Association committee on metal for brake shoes was held at the Western Railway Club rooms, Chicago, on Dec. 18. The chairman of the committee, Mr. G. W. Rhodes, had invited representatives of the engineering press and of the various brake-shoe companies to be present, and a goodly number attended. The committee desire to have as much aid as possible in carrying out the work of investigation. A series of tests will be made for the purpose of finding out facts about the different brake shoes and the metal used in them. The tests are divided into two forms, one being shop tests and the other road tests. Committees were appointed to conduct the tests, and the reports of the investigations will be submitted at a meeting to be held in April next. The M. C. B. committee will submit to the technical papers an outline of what shall form the road tests. The following data the committees are requested to observe and record:

a. A careful measurement of friction under similar conditions—namely, pressure, speed, area and temperature.

b. The pressure to be 100 pounds per square inch.

c. The speed to approximate to service on down grades—namely, 20 miles per hour.

d. The surface of the metal tested to be 1×4 inches.

e. The rate of wear of the material representing the brake shoe to be determined by one two-hour test of each metal.

f. The rate of wear of the material representing the wheel to be carefully recorded with each two-hour test.

NOTE.—The tests should be made as applied to steel-tired wheels, and chilled cast-iron wheels, each. Any other experiments which appear pertinent to the committees to be carried out and included in their report.

The Central of Georgia have placed the building of twenty freight and two passenger locomotives with the Baldwin Locomotive Works and the Central of New Jersey have ordered sixteen locomotives from the same makers.

The Pennsylvania Railroad Company have lately built at the Altoona shops six new handsome parlor chair cars for use on the Camden & Atlantic day service.

Design of a Compound Locomotive.

As it is now generally acknowledged that the compound principle, with its greater economy in using steam, may be availed of on railroads, I submit some sketches to illustrate a new design for a compound locomotive.

The design, or system, is especially adapted to American locomotives, and will, I believe, overcome the objectionable features of the compound locomotives heretofore used or projected.

As a method of expansion, this new system has the same efficiency as any other, while it insures equal work on both sides, requires no alteration in the usual link motion, can be readily worked as a simple engine with the larger cylinders, and is more symmetrical in appearance.

In this system the steam and exhaust passages cannot all be cored through the saddle, therefore the usual steam passages are used for the high-pressure exhaust, and the usual exhaust passages are used for the low-pressure exhaust. Some other means for admitting steam to the valves, without rendering access to them more difficult, must, therefore, be devised.

This is fully accomplished by means of a new valve arrangement shown in the drawings.

The valve, it will be noticed, is so accessible for inspection that, if the valve face is outlined on the outside of the valve by permanent marks, and the ports are similarly outlined on the cylinder, their relative positions are always apparent, thus greatly facilitating the correct setting of the valves.

No stuffing-boxes are required for the valve-stems, which helps offset the extra ones for the cylinders. The valve, which may be said to carry its steam chest with it, works between its seat and a plate which is secured to the cylinder by bolts and to the smoke-box by a flanged steam pipe. The plate and pipe may be considered fixtures, as the valve can be put in and taken out by disconnecting its stem and moving it either forward or backward. The bolts may serve as a guide to the valve by providing the yoke with extension pieces long enough to keep a bearing on the outer bolts as the valve reciprocates.

The pressure to hold the valve on its seat is determined by the comparative sizes of the openings in the bottom and top of the casing, or box, attached to and moving with the valve.

The top opening is provided with a piston which is held steam tight against the under side of the plate. This piston is hollow and forms an enlarged continuation of the steam pipe secured to the top of the plate and coinciding with an opening through the plate.

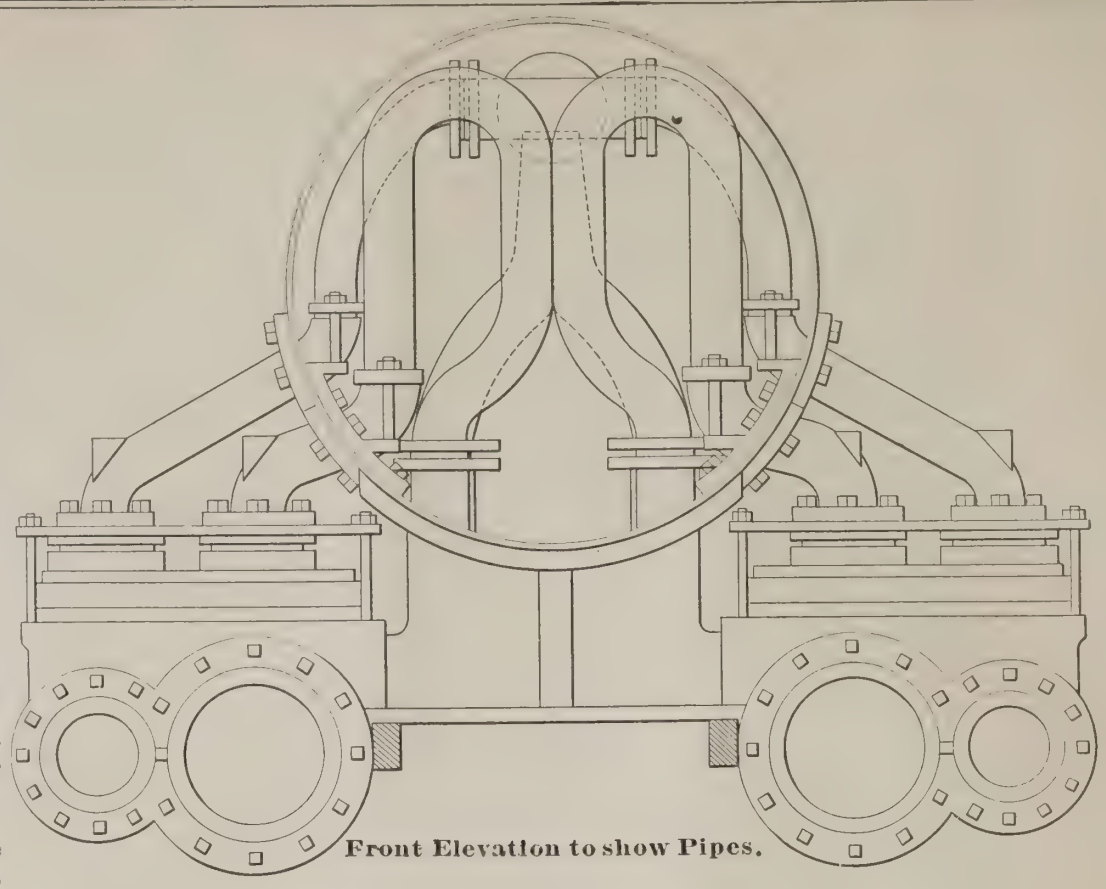
The opening in the piston is large enough for the steam pipe opening to remain at all times within it. When steam is shut off the piston can drop slightly and admit air to the valve.

The valve, that is the valve and box that moves with it, should be inclosed by a suitable light, removable casing to exclude dust and retain heat. The steam pipe may also be protected by lagging.

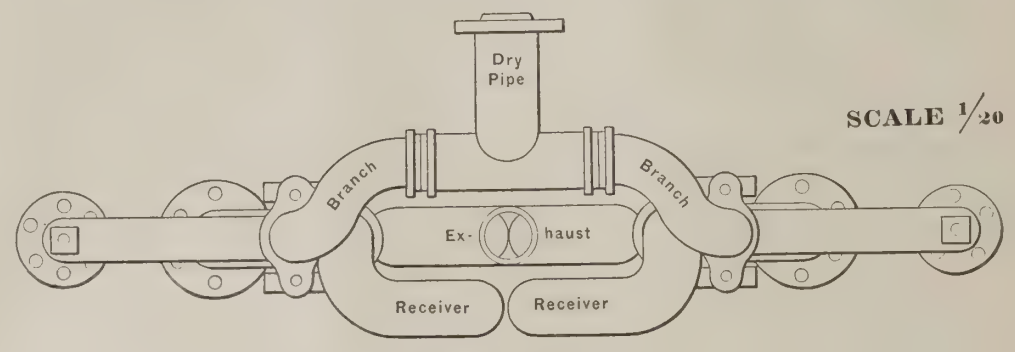
This valve is applicable to existing engines, and, I think, possesses advantages over other balanced valves.

It will be an easy matter to render an engine on this system automatically capable of using boiler steam in the large cylinders so long as the reverse lever is in the full notch forward or backward. The diagram shows one way of doing this. The small pistons will, in this case, have boiler pressure on both sides, and will exert no power to slip the drivers.

G. B. MAYNADIER.

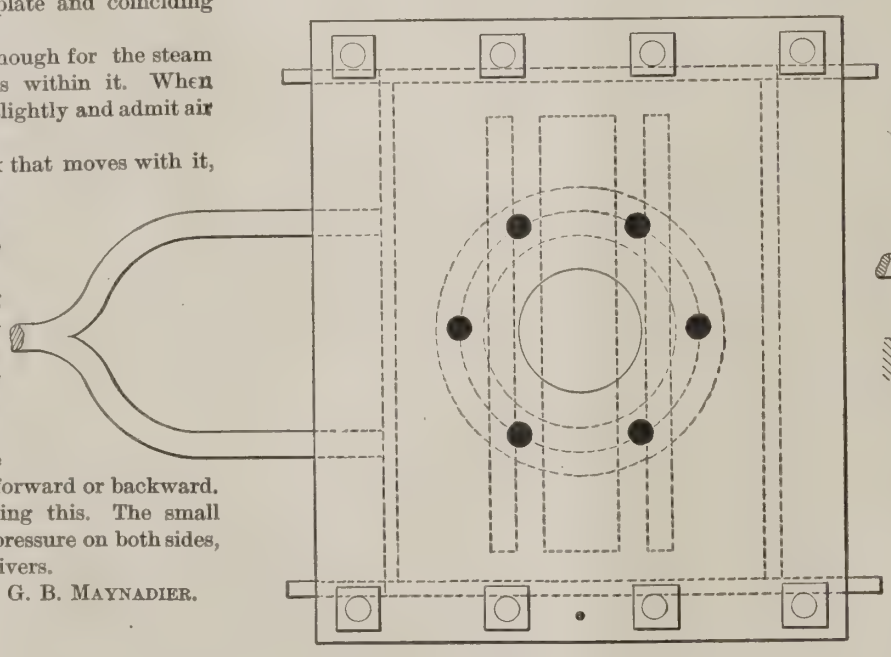


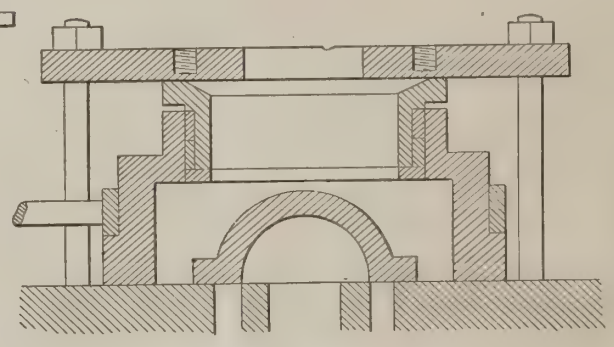
Front Elevation to show Pipes.



SCALE 1/20

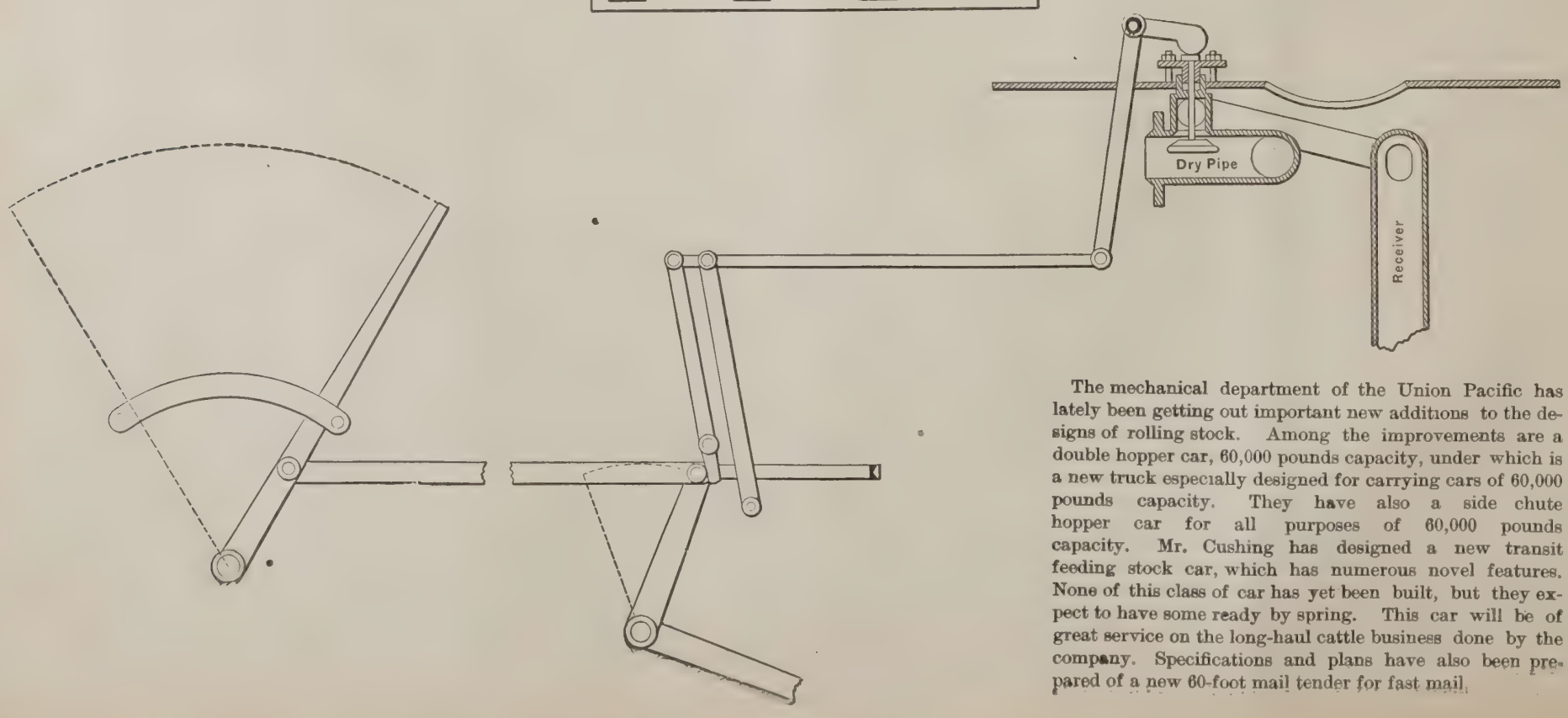
Plan of Pipes.





Plan and Section of Valve.

SCALE 1/8



The mechanical department of the Union Pacific has lately been getting out important new additions to the designs of rolling stock. Among the improvements are a double hopper car, 60,000 pounds capacity, under which is a new truck especially designed for carrying cars of 60,000 pounds capacity. They have also a side chute hopper car for all purposes of 60,000 pounds capacity. Mr. Cushing has designed a new transit feeding stock car, which has numerous novel features. None of this class of car has yet been built, but they expect to have some ready by spring. This car will be of great service on the long-haul cattle business done by the company. Specifications and plans have also been prepared of a new 60-foot mail tender for fast mail.

Testing Laboratories.

At the December meeting of the Western Railway Club Mr. George Gibbs introduced for discussion the above subject. He said:

The organization by railway companies of departments, headed by specialists, for the purpose of conducting experimental work and for passing upon the character of railway supplies is a comparatively new idea, and as yet confined to a few only of the greater railway systems of the country. We members of this small fraternity are in the habit of thinking we see great possible economies in railway operation in such departments, but we have, perhaps, some of the natural bias of enthusiasts entering an enormous field—that of the aggregation of professions called the "operating department"—and we should like to be told by those of broad experience in railway work where our greatest field of usefulness lies.

The head of a Department of "Tests and Experiments," as it may be called, occupies a position of great difficulty—if he did but know it. His position has not as yet been clearly defined (and this is a point we should consider to-day); if a scientific man purely, and inexperienced in practical work, he will almost certainly fail at first to appreciate the delicate nature of railway organization, will overstep the bounds of his legitimate field, and thus lose the respect and assistance of his superior officers when they are most needed. A man determined to at once bring everything to a fixed ideal standard may become worse than useless, a serious hindrance to economic operation. Supposing he has steered clear of both these rocks, there is another difficulty he has yet to surmount, that of confining his investigations to subjects which are susceptible of scientific analysis, and thereby furnish opinions which will command respect and not arouse ridicule. The danger that he will be asked to furnish solutions of each and every problem under the sun which seems to the practical man mysterious, and therefore "scientific," is not so remote as it might appear. No logical opinion, however, which is not founded upon exact data is reliable. I am here treating test departments as scientific bureaus merely; and is this not their proper function?

The tendency of modern times is toward specialization in every department of knowledge; a man is no longer an all-around business man or scientist either—he takes up a specialty and masters it to be a success. Thus, in railroading, the heads of departments, business men, have no time and are not qualified by training to attack and solve problems involving a knowledge of modern progress in the sciences. This specialization, followed to its logical conclusion, requires more than one expert in such a department, and since to-day a man cannot be both an engineer and a chemist, the question arises as to its organization. On some roads the two fields are separate and co-ordinate, on others one expert heads both. If the right man can be found, one with considerable experience in the methods of railway work, with executive ability and knowledge of the best lines upon which to lay out an experimental investigation, it seems probable that he would divide the work between the two sub-heads, chemical and physical, to better advantage, and put their conclusions in better practicai shape for his superior officer than could be done by either individually. However, this is a point upon which some difference of opinion may arise, and will naturally be somewhat governed by particular circumstances. The point is, that his reports be clear and accurate, and his conclusions based upon sufficient data.

Perhaps the first work of a department of this character, and work where it may prove of great utility—or the reverse, I may add—is the regulation of the character of the supplies, establishing a standard of quality, one practically obtainable, and afterward seeing that the same is maintained. This constitutes the routine work of the department, and the amount of worry and annoyance which may be saved the heads of the mechanical and purchasing departments, by having the contradictory claims of rival manufacturers definitely set at rest by actual test, can be readily appreciated.

Of course the economic results of this policy are of first importance; if establishing a standard of quality seriously increases the cost of supplies, it will be necessary to prove that the money is gotten back in other directions, which even when true is an exceedingly difficult matter. But I really believe that our experience has been satisfactory in this respect, taken as a whole. In some cases we do buy more costly material under specifications, but in others less so. Again, the cost is not proportionately increased with the quality, for several reasons, of which may be mentioned competition and the constant effort to improve quality to meet demands by cheaper processes. Then, at times, manufacturers are really able to supply cheaper goods under specications than without, as they know definitely what is called for and do not have to supply a higher grade to cover uncertainties due to improper handling by the purchaser; in other words, their responsibility is confined to filling certain definite tests, and the guarantee of service shifted to other shoulders.

We have here, then, a department designed to handle the great variety of subjects which are constantly arising in progressive railway management, from the position of scientific experts. One branch of the subject deals with a system of uniform tests designed to supply an accurate and quick method of arriving at the results of practical service; the other extends over the almost limitless field of the arts and sciences as applicable to the modern art of railroading.

ORIGIN OF TESTS DEPARTMENT.

Mr. Forsyth said: I would like to speak about the early history of testing, because I was connected with probably the first railway testing room in this country during the early years of its operation. It was started at Altoona, in a dingy old room over their wrecking shop, and Mr. Rhodes was the first engineer of tests, the first railroad engineer of tests. He was afterward followed there by Mr. Cloud, and for a time they were the only ones in charge of the department. I went there soon after Mr. Cloud, and the only apparatus we had was an old machine operated by hand, and that machine was used for tensile and transverse tests for probably a year or two, perhaps longer than that. Then came Professor Thurston's oil testing machine, which was a small apparatus. We used that probably over a year, trying to get some results from it. That was followed by Professor Thurston's torsion machine for measuring the work done in breaking a specimen. In course of time we accumulated a sufficient knowledge on the subject to begin to make specifications, and the result of those specifications was not only a benefit to the railroads, but also to the manufacturers, for it taught them how to make better material. That is the way it went until quite a number of railroads now have their testing departments. About 1876, I think, Doctor Dudley was put in charge of the chemical laboratory, and he, I think, was the first railway chemist that was employed in the United States. If any of you want to read an interesting record of the work done at the Altoona chemical laboratory, you will find it started in the *Engineering and Railroad Journal* a series of papers which Mr. Dudley and his assistants are now writing. The test rooms having gone through this period of establishing specifications and testing materials to those requirements, the work had virtually gotten into a state of routine, so that the principal occupation is the engineers' tests, and the railroad chemist is simply to see that the material meets the requirements. Now, of course, that is one of the most useful and legitimate purposes of these testing laboratories, but I think they have a larger and equally important function in original research, and that the matter of testing to meet specifications should be delegated to an assistant, and the man in charge should be allowed to devote a large portion of his time to original research. The result of this routine work that I spoke of is that we have been testing oils for lubrication for 15 years, and I think I can safely say that neither the railway chemists nor engineers of tests know very much about lubrication or the qualities of oils used in lubrication. What we want to get at is what is the best oil which can be furnished, say for $1, and give the most and best lubrication. So I suggest that as one of the subjects which the committee of the Master Mechanics' Association on tests should emphasize in their report, and that they recommend that the people in charge of these laboratories begin some further original research on the subject of lubricating oils. In the matter of metals, iron and steel, I think the test rooms can be given a great deal of credit for our knowledge of the quality of steel, and it is largely due to them that steel has been more generally introduced in the construction of locomotives and many other railroad structures, but I think there still remains something to be learned about the expense of steel and its other qualities, because in spite of the best knowledge we can get on the subject, it is a fact that although steel is recognized as a superior metal to iron, some of our best railroad men prefer for some parts to use wrought iron. In the matter of testing machines for metals, I think very little further remains to be done. The machines we use in this country I think are far superior to those used abroad. The Riehle and the Oleson are good enough for use on railroads, and the Emery is certainly adequate for the most refined investigation.

A discussion ensued on the testing of oils and on laboratory apparatus, in which Messrs. Shroyer, Ellis, Sargent, Davidson, Barnes and President Hickey took part.

Mr. Gibbs believed that a first-class laboratory should have a tensile testing machine of high capacity, a one-hundred ton machine. It should also have, for convenience, one small machine of 50,000 or 40,000 pounds capacity. An oil-testing machine I do not consider at the present time a necessity. Then a machine for rapidly testing a considerable number of springs is also needed, one that will not produce perhaps very accurate results, but will make the tests quickly. Of certain classes of springs we require every one to be tested, and it consumes considerable time if done in a very accurate manner. These three machines, I think, will start a fairly well-equipped laboratory. I think a 200,000-pound capacity machine can be bought for $1,600; a 40.000 for about $800. A spring testing machine should not cost as much as that.

Mr. SARGENT: Some time ago I inquired as to the probable cost of a first-class chemical laboratory, and I found it would take between $4,000 and $5,000 to equip one with the necessary apparatus to do ordinary work. I should say that $4,000 at least would be a low figure. With regard to the oil-testing machine, it seems to me that you can get accurate results, or true results, on the Thurston oil tester, but I think the Denton is the best machine.

Misdirected Inventive Labor.

It is a pity that a plain statement of the principles of mechanics is not more prominently taught in the common schools. Many things are taught to children that are much harder of comprehension, and there are few subjects that would be more useful. If people were better instructed in their youth on the laws of nature that relate to moving bodies, there would be much less time, labor and expense devoted to the invention of machines intended to elude nature's inflexible and unchangeable laws. The need for popular instruction in the principles of mechanics is peculiarly urgent in America, where there is a decided tendency among all classes to invent things. Familiarity with the laws of mechanics would supply a scientific creed that would save many an inventor from wandering after delusive fallacies.

The spread of education has been so general during the last quarter of a century that intelligent people ought to be getting raised far above believing in perpetual motion and similar vagaries, yet it is doubtful if the belief in such things is not spreading. The intangible force of electricity appears to predispose some minds to the belief that some such subtle power can be contrived to work round in a cycle in a way that will perform mechanical operations without experiencing diminution of kinetic energy. A combination of electricity and hydraulics appears to be a favorite means with inventors at present for trying to make something out of nothing. It is surprising how many cool-headed, sensible mechanics one finds who are deluded with notions that combinations of apparatus may be made to maintain motion without the application of power that proceeds from the conversion of heat energy into work. No inventor who works out a plausible theory of perpetual motion appears to have to wait long before he finds a capitalist ready to give financial support to his schemes. The so-called vibratory force that drew so much money to the Keeley motor was by no means an original delusion or means of deception with Keeley. Years before the Philadelphia deception was heard of a very bright American machinist wasted his life energies trying to convert vibration into constant motion. In a machine shop a piece of slim spring steel was fastened to a wall for some purpose. When the machinery was running the vibration transmitted to the wall gave this piece of steel a steady motion. One of the machinists watched this thing till he contrived to convince himself that the steel had more motion than it received from the vibration of the wall. He became ambitious to develop the principle which he supposed he had discovered, and the desire grew into a passion which ruined his life, and finally landed him in a lunatic asylum.

The writer some time ago, while visiting a friend in a city office, was introduced to what appeared to be a shrewd business man, who remarked that he had an interest in a machine which he would like us to examine. "Most extraordinary thing in the world," he said. We intimated our readiness to interview the extraordinary machine, and at once accompanied him to the building where it was to be seen. It was a confused make up of levers, pulleys, water buckets, pipes and springs. After looking it over and failing to follow any scheme to the mechanism, we asked the man in charge to start it up. He replied that it was not just ready for starting up then. Then we inquired how power was applied to it, and the inventor, who was looking after it, answered that it did not need any power, it had the power within itself. "Is it a perpetual motion apparatus?" we inquired. "You may call it that if you choose," said the inventor, "but I call it a 'moveometer.'" "Well, let us see it move," we again asked; but the inventor proceeded to give prolonged reasons for not starting it that day, and we learned afterward that one of his principal reasons for not starting it up was that he did not wish to have engineers prying into the secrets of the apparatus. The gentleman interested in the machine followed us out, and eagerly inquired, "What do you think of it?" We unhesitatingly pronounced it a fraud on general principles, and advised him to spend no money on it. "But," said he, "the thing works sometimes, and how can that be accounted for?" "If it works," we replied, "it is by power transmitted to it from some source of power." "Can you show how that can be done?" was the next question. We explained that we had not time or inclination to investigate the trickery of the machine, but assured the gentleman that we could recommend a mechanical engineer, whose business it was to examine machinery, and advised the employing of such an expert before more money was expended on the machine. We happened to meet the gentleman months afterward, and were informed that he regretted very much not having acted on the advice given, for it would have prevented him from wasting a considerable sum of money.

There are still many men working on machines of a similar character, and business men whose education has not embraced a knowledge of mechanical powers are ready to risk their money on worthless delusions, because certain useful inventions have brought rich returns to those who first got control of them. It looks as if many men enjoy the luxury of being humbugged. If those having the directing of education would perform their duties properly toward youth, a great deal of useless labor and worthless waste of means would be prevented. The business man who gambles his means upon a worthless invention, hardly deserves so much pity as the man of inventive turn who wastes for years constructive ingenuity in the pursuit of phantoms that want of properly directed education predisposes him to follow.

S. A. M.

Several circulars of inquiry from committees of the American Railway Master Mechanics' Association have been lately sent out by Secretary Sinclair. The committee on "The best form [and size of axles for heavy tenders' has sent out a circular which contains three engravings of axles, and members are requested to signify their preference. The committee having in charge how "To prevent corrosion of water tanks," of which Mr. W. J. Robertson is chairman, have sent out questions covering the subject. The committee on "Advantages and disadvantages of placing fire box above frames," of which Mr. F. B. Griffith is chairman, have sent out a circular containing 14 questions. They appear determined to obtain all the information there is available on the subject.

Railway Car Construction.

BY WILLIAM VOSS.

Fifteenth Paper.

Passenger Cars—Varieties.

All those cars that are equipped to regularly run in passenger trains, although not actually engaged in carrying passengers, must for the purpose of description be of necessity classed together. A division cannot very well be made, as all the leading features in most instances, even to outward appearance and dimensions, are much the same and, practically, the only difference is in the interior, which is arranged and furnished to suit the particular purpose the car may be intended for. In former years the exterior of these cars was not so elaborately finished nor so well taken care of as now, although all proper attention was given to the running gear and the safety appliances; but the constantly increasing desire for a handsome and uniform equipment has changed this until the baggage car of to-day is almost equal in appearance to the day coaches, and on some of the limited trains it is superior to the average, the money spent for the vestibules alone coming very near paying for the entire car of some years ago.

The length of this class of cars is also about the same, both for the sake of uniformity in appearance and for stability, a long and heavy car riding much more steadily than a short one, especially on an imperfectly aligned track. On branch trains where the traffic is too light to require a whole car of this length for each different branch of the service, the car is divided to accommodate two or more of these.

The combination most frequently made is that in which one-half of the car is arranged for smokers or second-class passengers and the other half for baggage, the two compartments being separated by a partition in which a door is provided for the accommodation of the trainmen. The division is usually made at the center of the car; but may be at any other point to suit the requirements. The interior of the smoking room differs from that of a second-class passenger car in length and number of seats only; the finish, decorations, trimmings and necessary adjuncts, such as saloon, water cooler and stoves, are all identical, except that one of the latter abominations is dispensed with because of the smaller space to be heated. The furniture of the baggage room consists of a heater, a locker for the belongings of trainmen, grease buckets, etc., and a bill case or desk.

If mail and express matter is handled on the train, the combination car, Fig. 101, precedes the last-mentioned car in the train. Cars expressly built for this service, whether they are combined cars or not, are always at the head of the train, principally because they are, for reasons of better security, without the usual end doors, and consequently if placed in any other position would block the passage to the rear. The furnishing of the express room, like that of a baggage room, is very simple; it consists of a stove, fuel box, fish rack, one lamp and a shelf to hold the receipt books, etc., of the messenger. In some instances a stationary safe is also added, but usually all valuables are contained in a portable iron box, which is removed at the end of the trip.

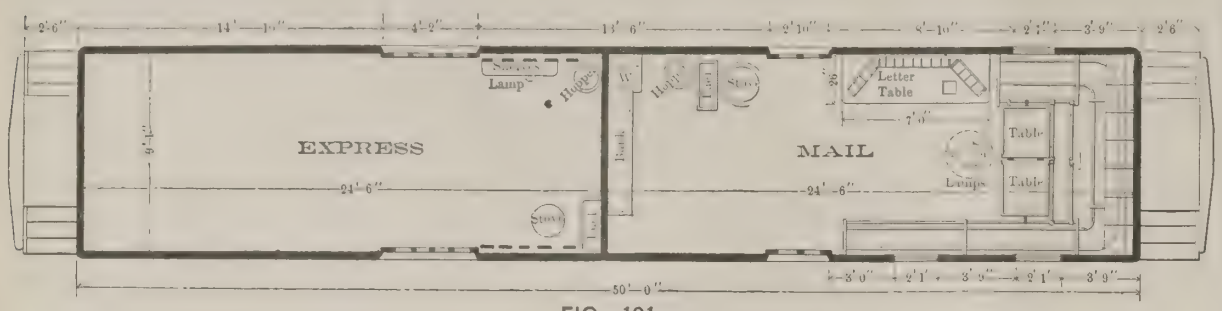


FIG. 101.

FIG. 102.

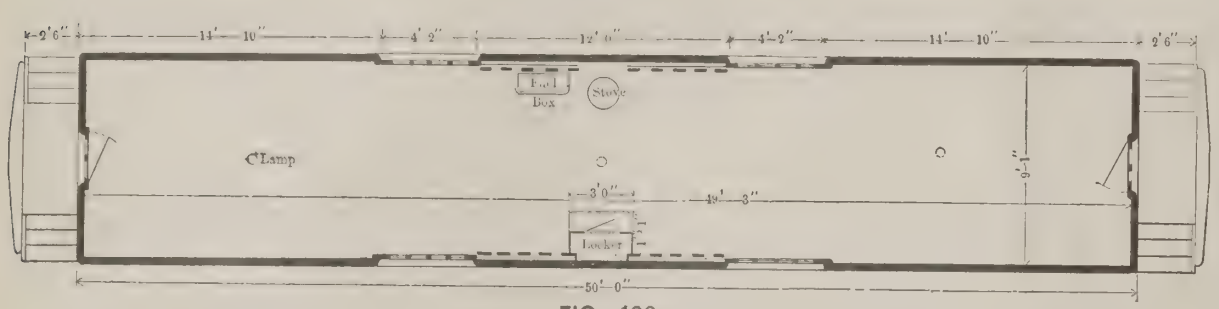


FIG. 103.

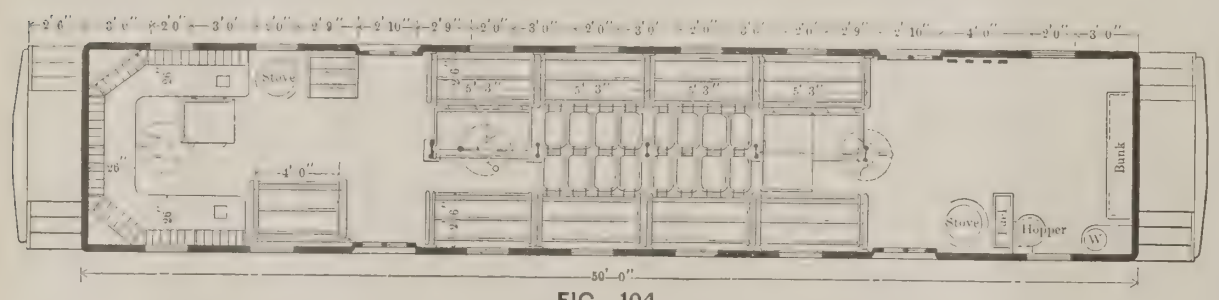


FIG. 104.

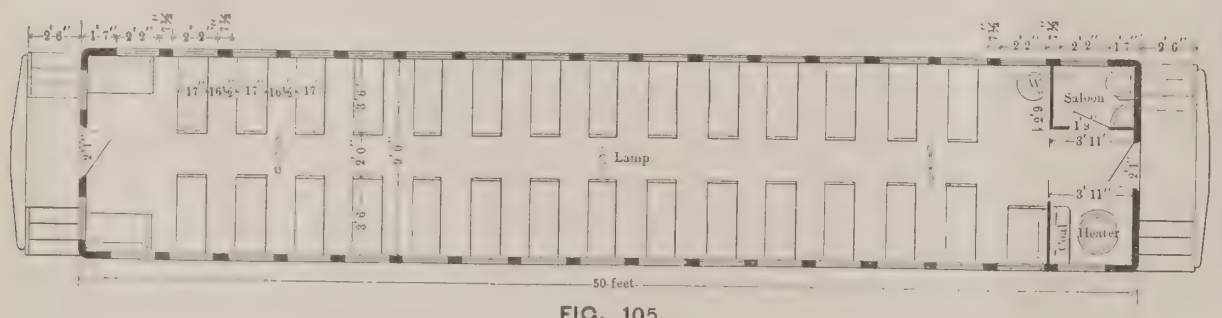


FIG. 105.

The equipment of the mail room is more elaborate, as a large amount of work has to be done in it, and the best facilities are required to get it done in time. The work of distributing mail is divided; all papers and other second-class matter go directly into their respective bags after they are sorted, but the letters must be tied in bundles before they can be disposed of, and because of this must be distributed separately. For this purpose the table and set of pigeon holes at one side of the room are intended. For the distribution of papers the older cars are fitted with a set of boxes arranged along three sides of a large sorting table in one end of the compartment; but this has been replaced in the modern cars by a rack, in which the bags and pouches are suspended, the object being to save the time consumed in transferring from the boxes. Some of the old style boxes are retained to make use of available space, but unless the work is very crowding they are rarely used. The sorting table is located in the open space formed by the rack, and is so constructed that either one or both halves can be let down or removed when not in use. The other end of the room is used for storing purposes, and also contains toilet facilities, stove, etc.

The two cars described and one day coach constitute a train on many branch roads; for still lighter traffic cars with three compartments are used. In the older cars the mail room is located in the center, a passageway at one side of it connecting the baggage room with the smoking compartment. Fig. 102 is the floor plan of a modern car of this class. In this the mail room has been moved to one end and the alley is dispensed with, by which some valuable space is made available. This car has to be turned at the end of every trip, but as this is generally done with the old style car (although it was especially designed to avoid it), for the reason that it is desirable to exclude the passengers from the baggage room, this cannot be considered a serious objection. The location of the partitions and other details of these two cars are so clearly shown in the drawings, and are so much like those of the other cars, that a description would be mere repetition.

On through trains combination cars are not used, unless we class the baggage cars with these when express matter is transported in them also. As this is frequently the case, these cars (see Fig. 103) are provided with two doors on each side, which allows both baggage and express packages to be loaded or unloaded at once, thus saving time at the stations where stops are made. The interior space is, however, not divided by a partition, a division being indicated only by the stove at one side and a locker at the other. There is but little, if any, change from the above when separate cars are provided for the purposes mentioned, except perhaps that cars used for express matter exclusively are for better security without end doors.

When the space required for handling mail exceeds 30 feet in length, a whole car is provided for this, as any remaining space would be too small for any other purpose. The minimum length of a postal car is 40 feet, and the maximum, 60 feet. Fig 104, which is the floor plan of a 50-foot car, represents probably the majority, the larger cars being used on very long runs only. The body and interior finish of the postal cars do not differ from those of the baggage cars other than that the end doors are again omitted, the side doors made narrower and a number of windows to better light the interior are added. This car, like the one already described, is fitted with the Harrison bag rack, although other designs embodying practically the same features are in use. A space of 12 feet, the distance between the end and the first side door, is reserved for the letter department, and contains a stamping table which, together with the letter cases above it, is arranged in horseshoe form. Part of the open space formed by this table may be occupied by a sorting table identical in construction with those used in the body of the car, or all of it may be left clear of it is so desired. Between the letter case and the door at one side is a folding pouch rack, and in the corresponding space at the other side a stove.

The other end of the car contains the usual conveniences, but is principally used for storing purposes. The central portion of the car, the space between the two sets of side doors, is set aside for the working of second-class matter. The rack when in position is in the shape of the letter H, in the ends of which are sorting tables each made in four sections, so it may be used either in part or as a whole. All of the tables and the center portion of the bag rack are made so they can be dropped or entirely removed, and the side racks, which are composed of sections 5 feet long, are arranged so they can be folded. This feature makes it possible to utilize the space, or any part of it, either for working mail or for storage, as may be required, the operation of changing being accomplished in a few moments.

Fig. 105 is the floor plan of a first-class day coach. The car has 31 seats, accommodating 61 passengers, and, in addition, affords space for a lavatory, a water tank and a heater. When ordinary coal or wood stoves are used for heating the car instead of a hot-water circulation, as in this instance, they must be placed in each end of the car, one of them taking the place now occupied by the heater and the other displacing the two seats in the diagonally opposite corner from this. The space taken up by the water cooler may be utilized for a short seat by locating the tank in the saloon, the faucet in that case being contained in an alcove fitted to the partition. Unusually long cars have a lavatory at each end to accommodate the increased number of passengers carried, but this is an exception rather than the rule. A wash stand is another exceptional and comparatively recent addition to the conveniences of an ordinary passenger car; in most cases where it is used it is located in the saloon, which is for this purpose sufficiently enlarged, but in some instances it is a separate affair, although occupying the same relative position.

Smoking or second-class cars are arranged precisely the same as the above, and, when expressly built for this purpose differ from these only in that they are not so handsomely equipped. On most of the older roads new cars are seldom used for this; there are always enough badly worn cars that may be rebuilt or used as they are for this service, and if more cars are required they are added to the first-class stock.

The above cars constitute the bulk of the equipment, but others, which were formerly looked upon as luxuries, and from the force of habit became an actual necessity, have increased so rapidly until now their number represents a considerable portion of the whole. These are the sleeping chair, or drawing-room and dining cars. All of these are usually much larger than ordinary cars and frequently attain a length of 70 feet exclusive of the platforms. This increase in length is made for the reasons that the space required for lavatories, toilet and smoking rooms, etc., contracts that actually occupied by passengers so much that a fair number of the latter cannot be accommodated in a shorter car; and because the longer cars, owing to their greater weight, are more comfortable to ride in.

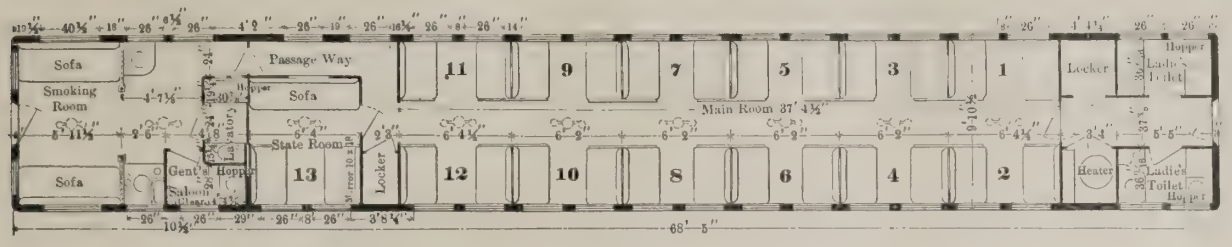


FIG. 106.

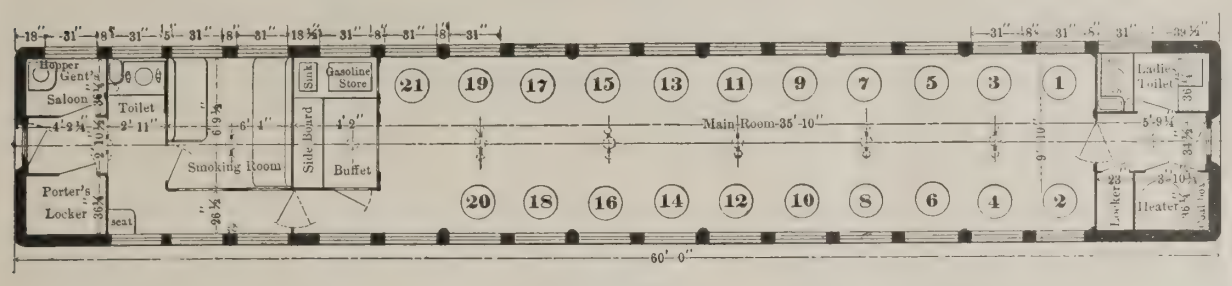


FIG. 107.

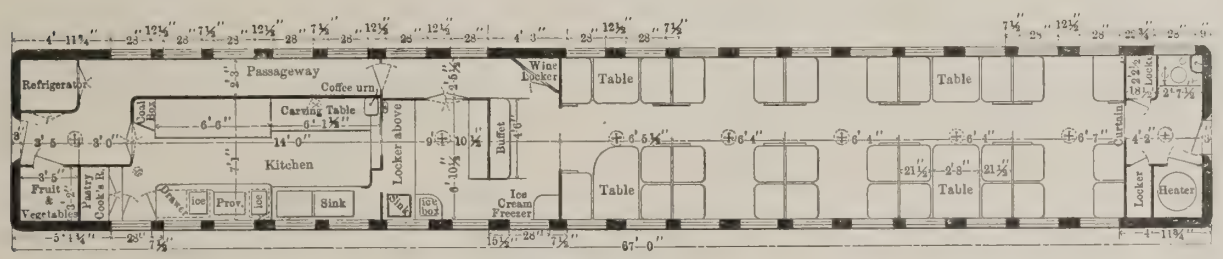


FIG. 108.

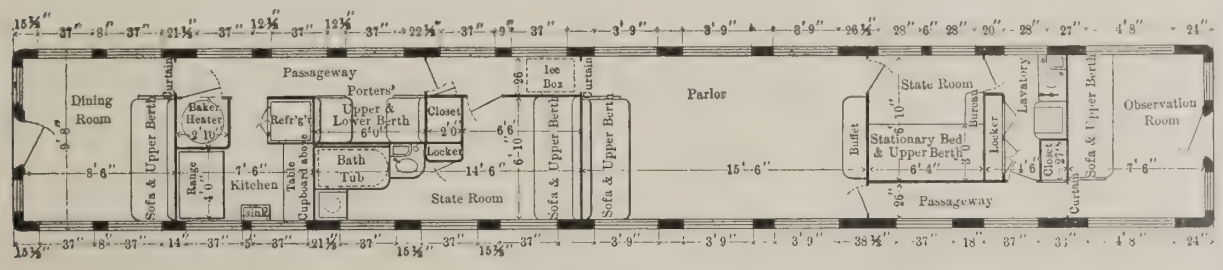


FIG. 109.

The division of the interior of sleeping cars is not always the same, changes being constantly made to introduce new conveniences or novelty of design; but these affect the less important features only and not the general arrangement; that is, the sleeping berths are always contained in the body of the car and the accessories at the ends.

In the example, Fig. 106, the main room is 37 feet and a fraction in length and contains 12 sections of two double seats each, which at night form the lower berths. Adjoining this is a stateroom with two seats and a sofa, or three berths at night. Connected with this is in this case, as in all modern cars, a private lavatory. The doors are so arranged that when the stateroom is not occupied a direct passage through the car may be maintained. The remaining portion of space at this end of the car is utilized for a smoking room, wash room and saloon. The other end of the car contains toilet rooms for ladies, the heater and a locker for storing linen, etc.

Sleeping cars have been built, and are to some extent used, where the whole interior is divided into staterooms, as in the Mann boudoir car. They have not met with any marked success in this country, although the principal objection to the compartment system, that of being isolated, is practically overcome by providing an interior passage. Another objection is that of cost; a car of this kind does not accommodate as large a number of people as an ordinary sleeping car of the same length, and the charges must therefore be higher for each berth, and if the passenger should not care to share the same room with a stranger, as but few would, he is compelled to pay double rates.

For people not satisfied with the comforts of an ordinary first-class passenger car for day travel, the so-called parlor cars are provided. These are unlike sleeping cars in that the main room is equipped with revolving easy chairs instead of the less comfortable stationary seats, and in that they are more roomy and airy because of the absence of the upper berths. In every other respect the car is precisely the same; the arrangement of the smoking and wash room, see Fig. 107, is quite different from that shown in connection with the sleeping car, but this is done to call attention to the different styles only, as either design may be used, and for either car.

Both classes of cars are also frequently fitted with a buffet the same or similar as here shown, and which is a very convenient adjunct on routes where a regular dining-car service does not exist. Its furniture consists of a side board, ice chest, gasoline or coal-oil stove, a small sink and a number of lockers, all in a very compact form and contained in a room less than four by seven feet in size. It is usually under the care of the porter, but the buffet of a sleeping car on very long runs, or one that is much crowded, has a special attendant.

There is one kind of cars resembling parlor cars so much that there is practically no difference; these are the chair cars. They might be termed second-class parlor cars if it were not that they are intended as much for night as for day travel. As a night car they are, however, not very popular, although it is possible to get some sleep and rest in a reclining chair, and they are made use of only where the traffic does not warrant the more expensive sleeping-car service.

Dining cars are now in use on all roads of any importance, that is, on all fast through trains between the larger cities, although the necessity for them is not so great as that for sleeping cars; still they are a great convenience to the traveling public, and are, as a rule, well patronized.

Fig. 108 is an illustration of this car as usually constructed. The dining room is 32 feet long, and is furnished with tables and seats for 29 persons. To prepare to order, and serve to so large a number of people at once, meals in every respect equal to those provided in first-class hotels necessarily requires much room and the best appliances obtainable. The remaining portion of the car, or nearly one-half of the entire space with the exception of a passage way, is therefore set aside for this purpose. The kitchen proper is 7 by 14 feet, not including the recess occupied by the pastry cook, and is furnished with a large range, a carving table, provision box, sink, etc. Between this and the dining room is a waiter's pantry, which, together with the side board and wine locker, takes up 10 feet in length. Beyond the kitchen are a large ice box and locker for vegetables and fruit. At the opposite end of the car are several lockers for linen, etc., a wash stand and a heater room.

A class of cars not yet mentioned, and which is too numerous to be passed by without notice, is represented in Fig. 109. The division of the interior varies with the purpose for which it is intended and with the notions of the designer or owner; the principal feature, that of combining the accommodations of all other cars into one, is the same in all, whether they are tourist, business or private cars.

The arrangement and the dimensions of the different rooms and passages of this particular car are sufficiently clear to serve as a guide, and a description is therefore not necessary.

Effect of Changing Smoke-stack.

During the discussion on Diameter of Smoke-stacks, at the last Master Mechanics' Convention, Mr. O. Stewart, of the Fitchburg, made the following remarks, which are worthy of being quoted in full :

"The subject of relative sizes of cylinder and smoke-stack, I know, is rather a delicate subject. On our road we have engines from 12 inches up to 20 inches cylinder diameter. A few months ago I was talking with one of my brother master mechanics. I asked him what sized smoke-stack he used on his engines. He said 16 inches inside diameter. Was that on everything? Yes. Well, now, I knew he had substantially the same kind of engines we did. In conversation with Mr. Boon, of the West Shore, I asked what sized smoke-stack he used; 13⅛ inches, he said. Was it on everything? Yes. It worked admirably, he said; no trouble with the steaming of his engines. But previous to this I had made some experiments with a size of stack for different sized cylinder engine. It is a well-known fact that the draught on the fire depends on the vacuum you make in the smoke arch. Now, then, we must have that vacuum in order to create a draught on the fire. The question that suggested itself to me was this: whether I would make the vacuum with a small exhaust pipe or whether I would make it with a small smoke-stack. To satisfy myself that there was something in it, I took a small engine that was running on the pay car. It had a 14 × 24 cylinder, and was running with a 15½-inch stack. One car, of course, is not much of a load for an engine, but as a pay car is a thing that has to go pretty lively, at times they lacked steam where they wanted it. So I took that engine and put into it a 13-inch stack. The engine made one trip. The next trip that she made I enlarged the exhaust nozzles from 2¾ to 2⅞. It made plenty of steam and ran a great deal freer. The next trip it made I put about 3 inches. Now these are facts. Whether that has any particular bearing on heavier freight engines or not is another question to be considered. Then I took an 18 × 24 cylinder engine that had always been a poor steamer, when she was dropped below 6 inches. On 6 inches she always had plenty of steam. Drop her into 8 inches on a hill and the pointer would go one way all the time—nothing would prevent it—and that was not the right way. I took that engine and put a 13¼ stack into it. I did not enlarge the exhaust pipe at all. I left it just as it was, but there was great improvement. With these things before me as having been tried on our own road, I came to the conclusion that it did make a difference whether an engine had a 16-inch stack, or whether it had a 13-inch stack with the same size of exhaust pipe.

Luminous Paint.

Until now the commercial manufacture of luminous paint has been confined to England, where a single factory turns out a small supply at a price of $3 a pound. This enormous cost seems to have prevented the use of the paint except as a curiosity, and it is fortunate that a certain firm named Mahren, at Triesch, in Austria, has found means to produce it and place it on the market at 50 cents a pound, or about one-sixth of the English price. Even at 50 cents a pound, a substance composed of roasted oyster shells and sulphur might, we should suppose, be manufactured at a good profit, but at that price it is likely to come into extensive use. Whenever it can absorb light during the day it will give it forth at night, and it is said that a railway car in England, which has had its ceiling painted with it, was so brilliantly illuminated that one could see to read a newspaper in it during the darkest night, without other light. With all due allowance for the enthusiasm of early experimenters, there is no doubt that cars with ceilings so painted would be pleasant to ride in, whether one could really see to read in them at night or not; and for making keyholes, stairways and sign boards luminous the paint would be invaluable. Its application to stairways is a particular obvious one, and the Austrian manufacturers furnish a kind of wall paper on which the paint can be used to better advantage than on the bare plastering. This paper, which is of a leathery texture, is first treated with lime-water, and then primed with a composition furnished by the same firm. After this is dry two thin coats of the luminous paint are applied, and the whole may then be varnished.

A Russian engineer who has lately been examining the Canadian Pacific Railway says his government has decided to build a railway across Siberia from the Ural Mountains to the Sea of Japan, at a point 6,000 miles from St. Petersburg. The country to be traversed as far as Lake Baikal is not unlike the Canadian Northwest.

The New York, Ontario & Western are about to order fifteen new passenger cars. They will be furnished with all the most approved equipments, and will be lighted with the Frost Dry Carburetter system.

Communications.

What is the Advantage of Compounding Locomotives?

Editor National Car and Locomotive Builder:

Can you tell me what was the original idea in compounding the locomotive? Was it to obtain greater power with higher speed, or was it done to obtain a better distribution of steam, with economy in fuel as a consequence? or was its primary object a saving in fuel by making more use of the steam, *i. e.*, using it twice, once as high and once as low-pressure steam, before its escape to the atmosphere? As the subject of compounding stands at present in the United States, there does not seem to be any very clearly defined object in view except, of course, the general one of economy in working, and as far as the experiments have gone they show but a narrow margin in this respect, 18 per cent. being about the average saving claimed for them. Exactly how this saving is brought about appears to be a mystery. It is declared to be there, but the answer to the question why, as given at the Western Railway Club, is: "We do not know." In spite of this, what the *Railway Age* calls the English "fad" of compounding locomotives bids fair to be a live question for some time to come. There appears to be enough in it, at least theoretically, to excite the interest of mechanical engineers, but it really looks doubtful if the rosy ideas of the enthusiasts, who have seized upon it with all the ardor of mechanical youth, will ever be realized. The writer remembers that when the study of the locomotive first became a matter of practical interest to him, how, in looking at it with every impression alert for improvement, the idea of generating steam and storing it till it reached a pressure of 80 pounds (which was then the limit), merely to pass it once through the cylinders and then get rid of it as quickly as possible, seemed an enormous waste; and this resulted in a plan being submitted to the late Sir Daniel Gooch (long before he attained the prefix to his name) to utilize this waste steam to heat the water in the tender, and since that time there have been hundreds of feed-water heaters derived from the exhaust, many of them claiming as large a percentage or saving as that of the present compound engine. It must be admitted that the margin of saving claimed for the compound is a very narrow one, especially as we are totally at sea as to which of two or three factors that margin is due, or whether it is not due to a combination of all of them. If this 18 per cent. saving were at all times accompanied by an increase in power and speed, we could afford to allow the particular factors that caused it to lie hidden, but this does not appear to be the invariable rule. Much is made of the steadier pressure upon the crank pin of the compound engine, but is this certain to be realized? I am only asking this question of the two-cylinder compound with two reverse levers, one "hooked up" the other "full over," which is said to be a favorite way of working them. I confess I don't see clearly how such an arrangement can result in a steadier pressure upon the crank pin, but in the absence of proof to the contrary, it may fairly be questioned whether this would result in advantage to a reciprocating engine, such as the locomotive. There is a position in the rear quarter of the crank pin's circle where it opposes the forward motion of the engine and the steadier the pressure upon it the greater the retardation. Is it not better, therefore, that the pressure should be decreased and the stored momentum allowed to do the work at this point as it does now in the ordinary engine?

Another advantage is claimed for compound engines in the steadier draft upon the fire. Is it not a well-known fact that in order to burn fuel economically the blast must be adjusted to each particular kind of fuel? It would seem, therefore, that if the steadier and softer blast of the compound engine has been found to have an influence in fuel saving, it has been a fortuitous circumstance, and has arisen from an accidental adaptability of the fuel to that kind of a blast rather than a factor to be calculated upon for a portion of the 18 per cent. saving.

It is somewhat curious that in this discussion the advantages derived from using steam of a higher pressure have never been prominently brought forward, notwithstanding it has been a prime factor in the introduction of compound engines. In raising steam up to the point where compression begins, the absorption of heat is so largely in excess of that required to increase the pressure after that point is passed, that I would ask you if there is not enough in this alone to account for a very large slice of the percentage of saving shown?

On the other hand, it is useless to say that the introduction of a third cylinder, with its necessary adjuncts, does not complicate a locomotive, for so long as the saving made is no greater than what can already be shown by careful design and judicious handling of the ordinary engine, it is a most decided complication. If a third cylinder be not used, and the compounding is done with two cylinders, the objection of complication is largely reduced; but if the result already attained by this style of compounding is to be the measure of its possible economy, then I would ask you, Is the game worth the candle? How often does it occur of two engines, of the same class, built in the same shops, from the same drawings, whose actual work will show as much difference as is shown between a compound and an ordinary engine. As I write there comes in a report of the performance of the Strong engine in a recent test against one of the most carefully-handled engines on the Erie road, showing a saving of 25 per cent. in favor of the Strong engine. Look at the subject as you will, there is no very bright promise in the future for the compound. If success should crown it, I am inclined to think that it will be found in two cylinders and higher pressure; but I am willing to let judgment stand arrested until the advent of knowledge.

JAMES HOWARD.

The Action of the Smith Fuel Economizer.

SACRAMENTO, Cal., Sept. 20, 1889.

Editor National Car and Locomotive Builder:

In your issue of September, 1889, among the editorials, under the head of "Trying to Sustain Combustion with Incombustible Elements," I notice some rather caustic remarks on the judgment of a master mechanic on what I suppose is the Southern California Railroad.

Although I am unacquainted with the gentleman to whom you refer, I have had some experience with the device you describe, which is called by its inventor "The Smith Fuel Economizer."

Allow me to say that you have been sadly misinformed as to the method of its action, and, apparently, as to the results. An exhaustive series of tests was made on this road by the direction of our superintendent of machinery, Mr. H. J. Small, by the testing department, of which I have charge.

Although complete records of the tests are preserved, I have only time to take therefrom the evaporative record of ten trips of 86 miles each.

The work on all trips was done on trains Nos. 12 and 13 between Sacramento and Oakland. The coal was from one lot, which was kept in two cars and used from only by the engine on test. The engineer and fireman were used to fuel tests, and all weighing of coal and measuring of water were done by a member of the Testing Department, who kept all results secret. Indeed, nothing was omitted that could add to the accuracy of results.

As you will notice, the saving is small, but on studying the results I think you will admit that there *is* a saving. The action is not due to dissociation of gases or any chemical change. The steam from the exhaust strikes the gases flowing rapidly toward the flues in such a way as to cause a swirl or eddy, which holds them until more perfect combustion can ensue.

Test of Engine 1,002, *Using the "Smith Economizer."*

Trip No.	Water evap'd per lb. coal. Lbs.	Equivalent evap. from and at 212°.
1	5.186	6 224
2	5.655	6.787
3	5.608	6.730
4	5.770	6.910
5	5.389	6.454
Average.....	5.521	6.620

Test of Engine 1,002, *Without "Smith Economizer."*

Trip No.	Water evap'd per lb. coal.	Equivalent evap. from and at 212°.
1	5.086	6.095
2	5.153	6.177
3	4.912	5.894
4	5.420	6.493
5	5,035	6.027
Average.....	5.121	6.137

I am, my dear sir, very respectfully yours,

ALBERT B. ROPES,
Eng'r of Tests, S. R. Co.

[The above letter, which was sent as a private communication, followed the editor to different places in Europe, and has only lately been received. A melancholy interest attaches to it, through the fact that the writer died shortly after the letter was written. Albert B. Ropes was one of the brightest of the class of young men rising into eminence through the department of tests. He had received an excellent education at the Stevens Institute, which was supplemented by engineering work, under Mr. G. W. Cushing, on the Northern Pacific and on the Philadelphia & Reading. He went with Mr. H. J. Small to the Southern Pacific as engineer of tests, with sufficient experience to make him thoroughly competent. Mr. Ropes was an industrious worker, a careful, patient investigator, and a keen searcher in the field of engineering science. There seemed to be a prosperous future for him, when he was cut off in the spring of his rising manhood.—ED.]

Improved Oil Cups.

Editor National Car and Locomotive Builder:

One of the most noticeable features to the observant man interested in railroad matters is the great difference in miles run to the pint of lubricating oil by roads similarly situated and equipped with similar engines. Miles run to pint of oil is a meaningless term, inasmuch as the cost per gallon of oil is the feature which really governs the cost per mile run for lubricating oil, and evidently it is the *cost* which is the true item to be considered.

It is not uncommon to find one road running eight to ten miles to the pint of oil, which costs but four or five cents per gallon. The neighboring road runs 20 to 25 miles per pint, on an oil costing 20 cents. It is not hard to see that the former road is running at a less cost per mile, *provided* the valve oil is used in a sight feed lubricator and the supply of same is limited per trip to a quantity only sufficient for this purpose. But when the engineer is allowed to draw such a supply of valve oil as he sees fit, it will be found that he is either using it undiluted in his rod cups, or mixing it with the cheap lubricating oil for the same purpose.

When valve oil, costing 40 cents a gallon, is used for this purpose, it will not be found that the cost per mile run for lubricating oil is as favorable as it might be. With the four or five cents a gallon oil, when the engines are 17 or 18 × 24 and eight-wheel and mogul type, on average roads, there is no trouble to get from 18 to 20 miles per pint, without the use of valve oil as a mixture. It is hard to make the average engineer believe this, as he is generally accustomed to oil "*everything*," including the rails and ties, whenever he stops. There are, of course, notable exceptions, and the wise master mechanic selects an exception, and by properly representing the case to the

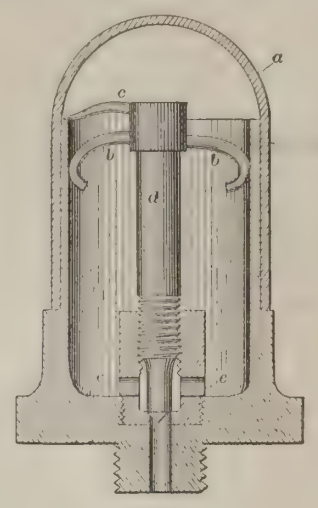


Fig. 1

man, and seeing that every other oiling station is passed without applying the oil can, it is made clear to the man that he has been using too much oil. He then takes a personal interest, and soon reaches the best mileage that can be obtained with the oil in use. When the other men see what can be done in this line, and disliking to be shown up on the performance sheet with a poor oil record, they too will drop into line, and surprising results will follow, as the eight or ten miles per pint soon grows to be 18 or 20.

Most master mechanics have a favorite oil cup. The writer, after observing the good and bad points of the many cups in use, believes that the guide cup, shown in Fig. 1, and the rod cup, in Fig. 2, have no superiors. The guide cup has the usual stem (*d*). Its top or head has a piece of brass spring wire (*b*) bearing against the side of the cup with sufficient friction to prevent the stem from moving except by hand. These wires also serve as a handle to turn the stem. A piece of wire (*c*) acts as a "marker," and fits into a slight notch in the rim of the cup when the engineer has found the proper feeding point. At the end of the run it is but a moment's work to pull off the cap (*a*) and close the feed, so that the usual loss of oil while the engine is standing in the house is prevented.

The cup is strong and neat in appearance, and in practice has shown that it has no superior. The rod cup, Fig. 2, is the ordinary high feed cup. The stem (*a*) is provided with a head or handle made of three-sixteenths round brass wire, and the check nut (*b*) the same, so that no special wrench is needed to adjust it, as the fingers alone can be used. The master mechanic who is looking for something in the line of cups which will be a "joy forever" will find it in these.

The plunger cup is a favorite with many master me-

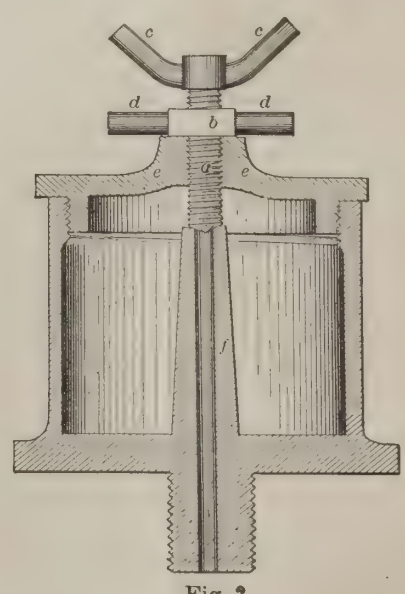


Fig. 2

chanics, and as ordinarily constructed, is liable to cause trouble unless the oil is carefully strained, as a small grain of sand or dirt will wedge the plunger and the feed ceases. But W. H. Thomas, S. M. P. of the E. T. V. & G. R. R., has brought the plunger cup to a high state of perfection. He uses as a plunger a wood-screw blank; that is he obtains from a wood-screw factory the finished blank, with its level head before the notch for the screw-driver or the thread are cut. The level or the under grade of the head forms a valve

which seats itself on the top end of the plunger barrel or cylinder. The plunger is flatted on one side one-sixteenth of an inch wide, and the cap of the cup, when screwed down solid, limits the lift of the plunger to one thirty-second of an inch. The guide cup has a stationary plunger with one side flatted, as above, and bottom side feed. Remarkably good results are obtained from these cups, but in no way better than from these shown in Figs. 1 and 2.

FRANK C. SMITH.

Cause of Excessive Cylinder Wear.

Editor National Car and Locomotive Builder:

I have noticed some comments in your journal on balance pistons. As I have had considerable experience with various piston packing in the last 20 years, I thought my experience in this line would be of use to some and I may have the pleasure of hearing from some one else by which I may learn a little also. Although nearly every road uses the so-called snap-ring packing, each road has a special method of its own, showing a great difference of opinion and judgment. Some use two rings and others three; some use $\frac{3}{4}$ square rings and others $\frac{5}{8}$ square, or $\frac{3}{4} \times \frac{7}{8}$, or $\frac{5}{8} \times \frac{3}{4}$, or $\frac{3}{4} \times \frac{1}{2}$, etc. Some allow $\frac{3}{32}$ snap, some $\frac{1}{8}$ and $\frac{1}{2}$ inch, etc.; some use solid heads, others full rings in sections, all showing a vast difference of judgment and opinion. We were using, up to about five years ago, the brass and babbitt packing set out with springs and set screws. It wore our cylinders perfect, and we stuck to it for about 12 years on account of the fine condition of our cylinders; but to save the cost of setting out the packing so often and the annoyance of delays that were caused by suddenly reversing the engines at a high speed, to save stock, etc., which would invariably set the packing down so we could hardly move the engine, we decided to put in the regular snap-ring packing. Everything went well until after the first three or four years; then we found that a cylinder boring bar was needed in our equipment of tools, and the natural question was, What was the cause of the cylinder wearing so fast on the bottom? No reasonable mind could think it was the weight of the piston head, working as it does free from dust and dirt. After studying it thoroughly, I found that after a piston had run a year it had come to a perfect joint on the bottom and was about $\frac{3}{64}$ open on the top. This, of course, lets the full pressure of steam on top of the piston in as far as the first snap-ring, which stands back $1\frac{1}{4}$ inches in general practice on a 20-inch cylinder; this, equal to 25 square inches at 120 pounds to square inch, equals 3,000 pounds. Now, when we consider this load, the speed and distance it has to travel, besides its own weight, we can plainly see the reasen why we hear a cylinder groan before we know the valve needs oil. I for one think a piston ought to be carried clear of the cylinder bottom, and the head ought to be solid, so there are no bolts to bother with. Would like to hear from your readers on the subject.

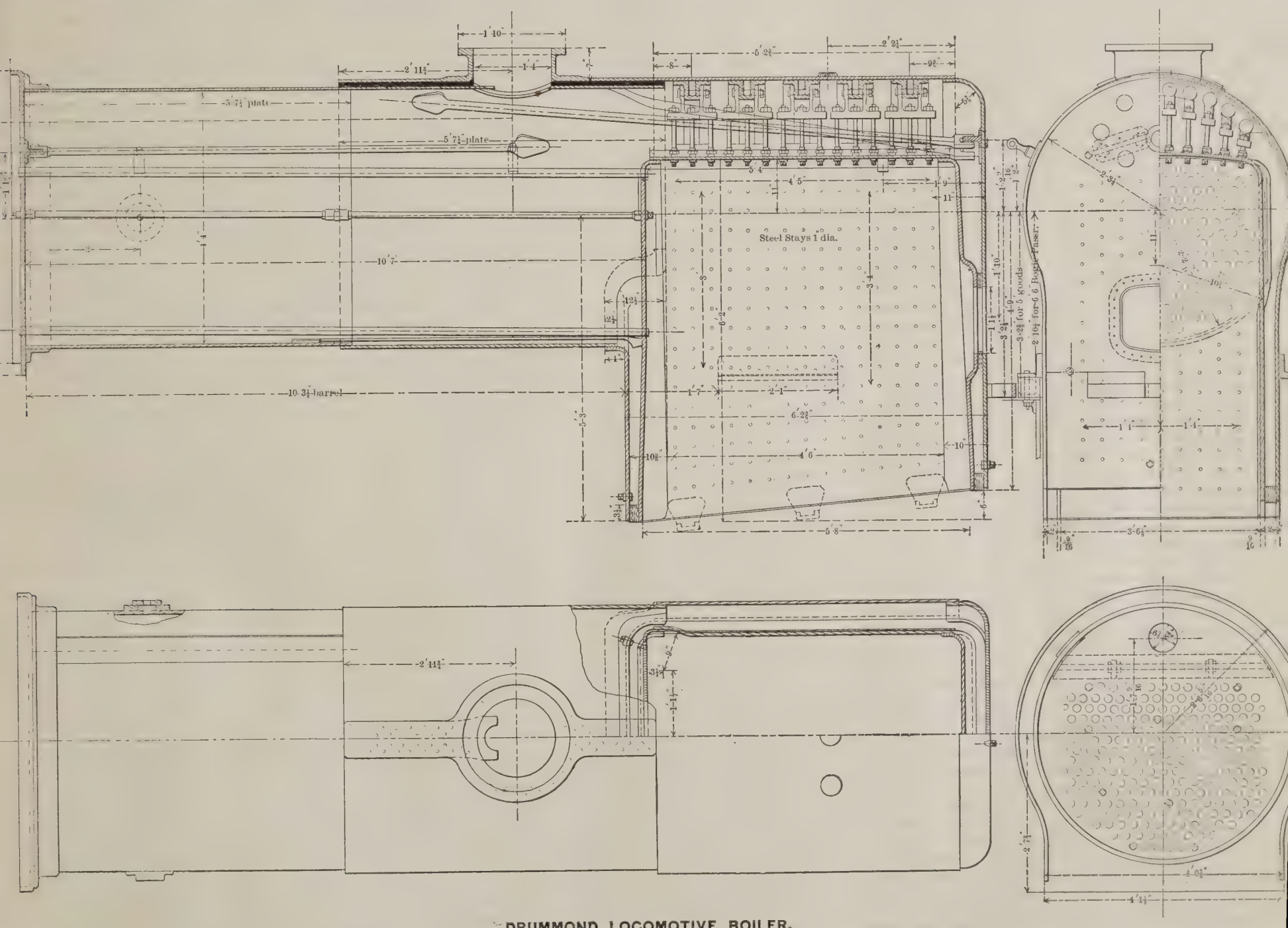
WM. J. THOMAS.

NORTH PACIFIC COAST RAILWAY,
SAUCELITO, Cal., Dec. 17, 1889.

The French were a little slow in beginning to construct railways. In 1832 Thiers, who was afterwards President of the French Republic, was sent by the king, Louis Phillip, to examine the Liverpool & Manchester Railway then two years in operation. The report made was so unfavorable that it took the French ten years more to find out that railroads were the coming channels of intercommunication.

It is reported that officers of the Chicago, Burlington & Quincy Railroad are considering a proposition to have a small room, about the size of a regular Pullman drawing room, fitted up expressly for the use of the passengers who desire to attend to business correspondence, It will be furnished with a phonograph and typewriter. The traveler can dictate his letter to the phonograph, turn it over to the typewriter, and have it prepared for the mail. It can be mailed on the train, and in this way a large amount of business can be done while speeding across the country at the rate of 40 miles an hour.

The use of the Colorado Midland's rotary snow shovel on the Denver, Texas & Fort Worth seems to have created a mild sensation. A local paper says: "It was put to work in a big cut where the snow was about 20 feet deep and made excellent headway, throwing an avalanche of snow 50 feet into the air at every revolution of the great plow, which literally bored itself through a mass as compact as sand. When about the centre of the cut a strange sight was witnessed. Those who were standing on either side of the plow were suddenly deluged with a shower of beef steaks. On all sides fell porterhouse, sirloin, round steaks, small steaks, shoulder steaks, with occasionally a slice of liver or a nicely-cut rib roast. It was thought at first that the engine had left the track and was boring its way through a butcher shop. Investigation, however, disclosed the fact that a herd of Texas cattle had crowded into the cut and had frozen and been buried in the drifts. Manager Meek immediately declared that no well regulated road should be without a rotary snow plow."



DRUMMOND LOCOMOTIVE BOILER.

Mr. D. Drummond, locomotive superintendent of the Caledonian Railway, believes that material economy results in the operating of locomotives by increasing the steam pressure above what has been usually employed. He has accordingly designed a boiler illustrated in the annexed engraving which carries with perfect safety a working pressure of 200 pounds. The boiler is now the standard for a class of fast passenger engines with cylinders 18 × 26 inches and driving wheels 78 inches diameter, and for a freight engine with the same size of cylinders as above and the driving wheels 60 inches diameter. The boiler is of the straight kind, like all locomotive boilers now built in Britain. There is a dome in front of the fire box, and the diameter of the shell of the boiler at the smallest ring is 52 inches. The shell is made of mild steel $\frac{9}{16}$ inch thick, and the fire box is of copper, with steel stays one inch diameter. The boiler head and other flanged parts have been formed in a hydraulic press, and the thickness is regulated to suit the nature of the strains to be sustained at local points. Double riveted lap joints are used on the circumferential seams and the longitudinal seams have but joints and welts. The crown sheet is supported by a peculiar form of stay of a design very clearly shown. The boiler contains 216 $1\frac{3}{4}$ inch tubes and 10 tubes $1\frac{1}{4}$ inch diameter. The tubes are 10 feet 7 inches long. The tubes provide 1,080 square feet of heating surface and the fire box 122 feet. The length of the fire box is 64 inches, and the area of the grate is $19\frac{1}{2}$ square feet.

The Richmond Locomotive and Machine Works, of Richmond, Va., are building 10 60-ton consolidation engines for the Richmond & Danville, with 20 × 24 cylinders, and two with 18 × 24 cylinders, for the Seaboard Air Line, and the same number for the Chesapeake & Ohio. The latter engines will weigh 65 tons, and the former 48 tons. Four 40-ton 17 × 24 passenger locomotives are being built for the Atlantic & Danville. The company also has considerable government work under contract. A large amount of new machinery has been added, and several extensions to the works built. A new machine shop, 100 × 106, has been completed, and a new boiler shop, 185 × 92 feet, is being erected. Nearly 500 men are now employed by the company.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

JANUARY, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Theoretical Advantages of Compound Locomotives.

In his interesting letter, published in another column of this paper, Mr. James Howard raises some pertinent and seasonable questions under the caption, "What is the advantage of compounding locomotives?" The practice of compounding locomotive engines has obtained considerable prevalence in all countries having much railroad mileage except in North America, and the question naturally arose, if the railroad engineers in other countries have deemed it economical to use compound locomotives, why is it not good policy for the heads of our railroad mechanical departments to do likewise. The response to this highly practical query has been the determination on the part of several of our locomotive builders and superintendents of motive power to build experimental compound locomotives and find out for themselves what merit there is in the system. Within the last six weeks more than one compound locomotive of American design and construction have been put to work. Records of the engines' performances will no doubt be made public soon, but in the meantime it is natural for those interested in motive power matters to ask for explanations of how a compound locomotive may be made to haul cars at less cost than is incurred with a simple engine?

There are writers ready and willing to demonstrate to the fraction of a cent the saving that can be effected by a compound engine, and to explain with fluency the origin of every unit of heat saved, but we have never considered ourselves equal to this task. There is no doubt that compound condensing engines have proved more economical in the use of steam than simple engines using the same ratio of expansion, but how this result has been brought about is a question that has excited no end of controversy. For years after compound marine engines began to be acknowledged as using steam with far greater economy than simple engines, there were eminent steam engineers who insisted that this achievement was due to higher steam pressures and better mechanism than had been employed in the simple engines that were falling into disrepute. A revival of the periodical abuse of the link motion came up very strong, and the practice that the link motion has of wire drawing steam during admission and causing compression at the end of the stroke were given as explanations of why a simple engine could not use the steam as economically as engines that were designed to expand the steam in two or more cylinders. Various high-class engines were built with valve motion that would admit the steam at practically boiler pressure, cut it off quickly and permit of expansion close to the atmospheric line before the passage to the condenser was opened. The indicator diagrams from such engines were remarkably fine, and appeared to be the ideal of what an indicator diagram should be, yet the engines did not work steam so economically as very cheap forms of compound engines, and the wear and tear of machinery was much greater. The Cromwell Steamship line had some engines of this high-class simple type. In locomotive practice the Stevens, the Wilson and the Strong valve gears have been employed to perform functions the same as those sought for in the improved marine simple engines.

The explanations given to account for the superior economy of the compound marine engine are to a great extent theories, but these theories are supported by a great many facts obtained from experiments conducted by the ablest steam engineers in the profession. The theories that explain why the compound marine engine uses steam more economically than a simple can be applied to account for a compound locomotive using the steam to greater advantage than a simple engine.

In the working of a simple engine with boiler pressure of 180 pounds absolute pressure the steam enters the cylinder at about 373 degrees Fahr., and escapes at nearly atmospheric pressure with a temperature of about 220 degrees. The metal of the cylinder inclines to maintain an even temperature at some average point between the high admission and the low exhaust temperatures. When the steam enters the cylinder it goes into a comparatively cool chamber, and the metal of the cylinder walls and head draw some heat from the steam. The portion of the steam robbed of its heat becomes spray, and helps to dampen the steam that continues to pass into the cylinder. As the events of the stroke go on and release of pressure takes place after the opening of the exhaust, the steam which became wasted at the beginning of the stroke, while the pressure was high, is now ready to flash back into steam, which it does at the instant it is passing into the exhaust part, and it draws heat from the cylinder metal to aid in the act of vaporization, the whole of the stolen heat being carried up the chimney. This heat taken from the cylinder has to be returned by the incoming steam of the return stroke. The loss of heat is calculated to be proportionate to the difference in temperature between the initial and exhaust steam.

In a compound locomotive working with steam of the same pressure, the difference in temperature would be much smaller than in the simple engine. The pressure in the receiver would be about 70 pounds absolute, and the resulting temperature about 303 degrees. The difference then would be between 373 degrees and 303 degrees—70 degrees; while in the simple engine it would be the difference between 373 degrees and 220 degrees—153 degrees. There would also be a saving of steam in the compound by the re-evaporated steam passing into the low-pressure cylinder and there doing work; and there being clearance spaces for only one cylinder to fill with steam, there would be some more saving to credit to the compound.

In the working of a simple engine with high-pressure steam expanding well down, there is an immense pressure imparted to the mechanism at the beginning of the stroke when the crank is not in the position to transmit the power to advantage. This is hard on the machinery. In the compound engine the work is more evenly distributed throughout the stroke, consequently the strains and shocks are lighter. Among other advantages claimed for the compound are that there being smaller unbalanced pressures there is less steam leakage of pistons and valves and less rubbing friction to overcome.

How far these advantages are realized in practice appears yet to be an open question. There is the most violent conflict of opinion on the subject among locomotive superintendents in Europe, where they ought to be well informed about the comparative value of simple and compound locomotives. A month spent in the home of the compound locomotive took away from the writer a great deal of the faith previously held in that type of engine. None but those immediately interested in the success of compound locomotives had any good to say about them. Where there are so many doubting Thomases in the countries where compound locomotives are best known, it is natural that many people among us should be filled with the criticisms similar to those contained in the letter which has been the text of our remarks.

Can Bad Feed Water Be Made Innocuous?

The highly interesting discussion on Purification of Feed Water, which took place at the December meeting of the Northwestern Railway Club, indicates that the men most concerned in preserving locomotive boilers from the pernicious effects of impure feed water are becoming profoundly educated on the causes and effects of boiler incrustation. The paramount importance of the quality of water used in locomotive boilers has long been recognized by all master mechanics in the limestone regions, for the effects of scale-forming water is forced upon their attention in an unmistakable manner. When phenomena influencing locomotive operatives reach beyond the control of individual master mechanics, they are generally referred to the collective wisdom of the Railway Master Mechanics' Association, and, accordingly, we find that "incrustation of boilers" was entered for investigation soon after the association was formed. The difficulties to be surmounted may be inferred from the fact that the subject has been up for investigation or discussed in some form at nearly every convention held by the Association. For years the different members investigating the subject were very hopeful of being successful in devising means of neutralizing the evil effects of the solid impurities carried into the boiler by the feed water. Very protracted and carefully conducted experiments were carried out with appliances for preventing incrustation from forming on the heating surfaces. Various compounds were tried for separating the lime salts from the water and depositing them in the form of mud where they could be blown out. Other experiments were tried with a view of separating the impurities from the water before it was taken into the tender. No subject has ever come before the association that was more thoroughly investigated or subjected to more effectual experiments. The trend of the later reports on boiler incrustation has been to the effect that the only successful way to prevent destruction of boiler plates and waste of fuel from the presence of scale on the heating surface was to select feed water that was fairly free from lime salts. Recommendations were added advising railroad companies to locate their water stations on streams containing soft surface water and to collect surface water in reservoirs.

The policy thus recommended has been largely followed, yet the result is far from being satisfactory. A dry season dries up all surface supplies and throws back railroad companies upon wells for the water supply. Dry seasons are not rare, and their recurrence brings up for solution the questions that were so intelligently discussed by the Northwestern Railway Club. A striking aspect of this discussion was the familiarity which the master mechanics displayed with the scientific features of the questions involved.

Great saving has accrued to railroad companies from the information diffused by the Master Mechanics' Association and other organizations regarding water impurities, for it has led to the systematic practice of selecting feed water; but after the best practical selections are made, there still remains on the hands of many railroad companies an average of very hard water. The question to be solved is, how can this water be used in boilers without causing destruction of heating surfaces and material loss of heat? The loss of heat due to the presence of scale on the heating surfaces is not nearly so serious as Mr. Pattee made it out to be, yet it is serious enough to demand a remedy. The theory advanced that $\frac{1}{16}$ inch of scale on the heating surface led to heat loss of 20 per cent. increasing in quick ratio with increase of thickness is a fallacy, which every master mechanic ought readily to detect. There is very little difference in the steaming of a boiler after it gets badly coated with scale. The matter was, however, decided scientifically some years ago by very thorough experiments conducted at Munich in Bavaria. Tests were first made in a clean boiler with soft water and the quantity evaporated per hour carefully recorded. Water saturated with sulphate of lime was then used, and the test was continued for 195 hours, the quantity of water evaporated each hour being again noted. When the trial was completed the scale averaged $\frac{1}{4}$ inch, yet little or no increase of the coal required to maintain steam was perceptible. Other boiler trials conducted by the Society of Mulhouse led substantially to the same conclusion. But even if there is little loss of heat due directly to the presence of non-conducting scale on the sheets, there is a great extra expense for boiler repairs and loss of heat due to leakage, besides the delays, expense and inconvenience resulting from having to take engines prematurely out of service for boiler repairs. This ought to stimulate all railroad officers concerned to use every means in their power to carry out any practical method of neutralizing the damaging effect of impure feed water.

Chemical and mechanical means have both been repeatedly tried to prevent water impurities from destroying the fire-box sheets and flues, and the general verdict is against them; yet we repeatedly hear of master mechanics who have extremely bad water to deal with who are successfully using mechanical purifiers or chemical compounds. When a railroad company has done everything that would promise a return of the investment to obtain good water, and dry seasons or other misfortunes have thrown them back upon hard wells for a supply, it behooves the mechanical department to use successfully any means presented or that can be devised for preventing the bad water from injuring the boilers. If one master mechanic can use mechanical or chemical remedies successfully another man who fails to make a success of the same agencies with similar water is failing in his duty to the company he serves. We can conceive of no greater example of imbecility when incrustation is rapidly destroying the efficiency of the locomotives he is employed to keep in service, than for a railway officer to fold his hands and say what are we going to do about it? There are, undoubtedly, worthless compounds offered as remedies against scale and there are purifiers that fail to purify; but the best of chemicals and the most efficient of purifiers will fail unless they are properly managed. Sending barrels of compound to round-houses with vague orders that it shall be used, and putting mechanical purifiers in the hands of indifferent or hostile engineers without special supervision, is to invite failure. We have repeatedly found that methods for purifying water or for carrying the impurities out of the boilers worked well when first introduced, but that they afterwards proved failures. The same thing has frequently happened with other improvements to railway machinery. Is it not strange that a thing is a success at first and a failure afterwards? The cause of this is no mystery to men who circulate around with their eyes open. The success was achieved when supervision was active and the men operating the devices were compelled to give them proper attention. Failure came when the period of nov-

elty had worn off and carelessness had assumed its normal sway.

There are waters so heavily charged with solids in solution that they cannot be used economically in a boiler evaporating the quantity of water necessary to supply steam for a locomotive. But ordinary bad feed water can be rendered fairly innocuous if the proper means are energetically employed to effect that end. The problem of using bad water with as little injury as possible to boilers is on the hands of many master mechanics; and its solution cannot be evaded. To work out the solution requires intelligence, energy and perseverance, and the men who display the characteristics required for overcoming the difficulties to be encountered are those likely to make their mark as efficient officers.

Testing Laboratories.

The papers published on another page on Testing Laboratories for railroads will be read with pleasure and edification, for they throw a clear light upon a subject that is of growing importance and is slowly becoming recognized at its true value. Certain classes of railroad officers interested directly in the economical operation of the companies they served have displayed a blind hostility to testing laboratories and to the work done in such establishments, that has been by no means creditable to their sagacity or profitable to the roads they worked for. They appeared to infer that the employing of experts to test material and to make investigations of engineering practice was interfering with their business, when nothing of the kind was intended. A large railroad company is necessarily a great purchaser of an immense variety of goods, and no set of officers can be competent judges of the quality of all the goods. The responsible officers of the company have either to depend on the honesty of the parties supplying goods or institute a system of testing the quality of the articles bought. When goods are purchased from responsible firms they will generally be found as represented, but not in all cases, and it is the duty of buyers with proper business instincts to find out for themselves that their purchases are of the quality paid for. The maintenance of a department of tests is the only way to have this duty properly performed. American railroad companies wisely follow the practice of buying the greater portion of their equipment and supplies from manufacturers instead of becoming manufacturers themselves, as many foreign railroad companies do, and the safety and economy of buying in the open market are to a great extent dependent upon the purchasers possessing effectual and unquestionable checks upon the quality of the goods furnished. The proper functions of a test department are admirably stated in Mr. Gibbs' address.

Railroad companies that can afford to maintain an efficient department of tests undoubtedly have advantages over the smaller corporations that must accept on the good faith of the merchant the supplies they use. It is no secret that goods rejected by the department of tests of large roads for cause are often sent to smaller roads where good provision for making tests has not been introduced. A decided need of the day is for small railroad companies to combine in maintaining co-operative departments of tests where their supplies and material would be examined, giving them the same advantage as buyers now possess by their larger rivals. A proposal similar to this was discussed a good deal six or seven years ago and nothing came of it, principally because testing laboratories had not been perfected and had not been in use long enough to demonstrate their utility. Their value and their working are now properly understood, and the officers of small roads could not do a better service to their companies than by entering into a combination of the kind suggested.

Public discussions like what took place in the Western Railway Club on Testing Laboratories are a public benefit, inasmuch as they give plain facts and much needed information about the work that is performed in railroad laboratories. Master mechanics, master car builders and purchasing agents ought to be informed clearly respecting the work done in laboratories, for most of these officers, who do not happen to be connected with roads where laboratories are in use, know little or nothing about them. Many railroad officers who are expected to avail themselves of investigations that can be made by the tests department might gain a great deal of useful information that they never receive if they would reflect with liberality and intelligence on the capacity of the men and of the apparatus at their command. In too many instances men who ought to be constantly using the laboratory as an auxiliary in their business have made application for information, and if the data given did not agree with their preconceived opinions, or if the information furnished was not perfectly conclusive, they were ready to declare that keeping up a tests department was a worthless expenditure of money. More than one department of tests has been for a time robbed of its usefulness by this foolish method of obstruction; but the men who tried to stem the tide of this wave of progress have been eventually swept out of sight.

Besides the useful routine work of examining material, a department of tests supplies a class of men eminently adapted for carrying on the engineering investigations that every railroad company of any great size ought to be able to have done by experts. It is certain that millions of dollars have been wasted by railroad companies through the employment of vicious designs of locomotives and worthless attachments to all kinds of rolling stock, whose want of merit an expert with proper instruments could have readily demonstrated. The deciding respecting the working of a new design of locomotive, or of any novel or radically changed part, has generally been done by rough guessing, wherein prejudice was often more potent than observation. It has generally been assumed that any engineer can make the tests necessary to ascertain the value of a new design or new attachment, yet the capacity for making tests properly requires as careful training as any business involving developed skill. If the corps of engineers employed in a department of test were employed systematically to ascertain the value of all improved appliances, the training they would receive would soon make them valuable experts. There would then be fewer meritorious inventions condemned through prejudice, and fewer worthless devices forced into use through interested favor.

The Poor Inventor.

No people in the world have displayed so much fertility of inventive ability as Americans, and the government very wisely provides fairly good and easy means whereby an inventor may protect by patent the product of his inventive talents and industry. But one cannot read over the list of patents granted monthly without being impressed with the vast amount of money and energy that is being constantly expended on devices that can never be of use to the inventor or to any one else. It very often happens that a man of an inventive turn supposes an improvement is wanted on some device, such as a car coupler, and he sets to work thinking and planning and experimenting to devise something better than others have produced. After a time he gets a combination of parts ready, and if they will act, even by a stretch of the imagination, to say nothing of material, as a coupler, a patent lawyer is applied to and the invention is protected by letters patent.

We have repeatedly known of inventors mortgaging their slim belongings to raise money to defray the expense of obtaining a patent on articles that no one but the inventor imagined had the least claim to merit as an invention. When the patent attorney's fees are paid the poor inventor's outlay on a worthless production is by no means over. As soon as his name appears in the Patent Record he becomes the object of attack by a set of patent broker swindlers who endeavor to obtain money on the false pretense of being able to sell the patent or interest capitalists in it. He will receive letters from oily knaves saying: "We have carefully examined your patent, and find it both meritorious and of practical utility." With a few more words of flattery, in the course of which he may be informed that he is dealing with no patent broker swindling concern, he is requested to send ten dollars to the benefactors of the human race who have addressed him, and he will at once enter on the road to fame and fortune through the medium of some inventors' patent association. He may send any number of contributions to the frauds doing business under the name of an inventors' association, but the chances are that he will receive no return more substantial than promises intended as fresh bait.

We recently learned the particulars of a case where an inventor paid his ten dollars as the preliminary blood money to make connection with an inventors' patent association, expecting that it would aid him in disposing of his patent. A short time afterward a letter was sent to him asking if he would grant the rights to the patent in certain States for a tract of land, some particulars of which were sent. He thought the offer good, and answered that he would accept. Then came another letter saying that certain preliminaries would have to be gone through in making the transfer of the land, and asking him to send $75 to defray the expense. The end of it was that there was no offer made; the whole thing was a fraudulent pretense for getting more money from him.

Certain officials in California have lately got some of the patent swindlers in that State arrested, and there is a fair prospect that they will go to the penitentiary. It is a good example for the officers of other States to follow.

The government makes the best provision possible for the protection of inventions, so far as the rights to the patent are concerned, and this is the means of bringing in business from every part of the Union, many of the men who take out patents having but small opportunities of judging of the ways of swindlers. Under these circumstances, it would only be fair and just for the Patent Office authorities to take cognizance of the action of the harpies who habitually prey upon the hopes, poverty and want of experience of inventors. At present the poor inventor is like the frog under the harrow: whatever way he turns is only to put himself in the way of getting a new blow. The Patent Office takes his money and raises his hopes; the sales agents suck out of him his last dollar without rendering him any return; and the public jeer at his misfortunes. There is now and again a big prize for inventors, but the business is a lottery, where the blanks are as the sands of the seashore in number.

Places for Holding the Next Conventions.

The Executive Committee of the American Railway Master Mechanics' Association have decided to hold the next annual convention at Chattanooga, Tenn. The proprietors of the new hotel in course of construction on Lookout Mountain have given emphatic assurances that the hotel will be ready for receiving guests in the beginning of May. An invitation was sent by the Executive Committee of the Master Mechanics' Association to the Executive Committee of the Master Car Builders' Association to hold their convention at Chattanooga also, but we are informed that the Master Car Builders have decided to meet at Old Point Comfort. The Western Railway Club made the request that the Master Car Builders should meet at Chattanooga. Charleston had to be abandoned for want of hotel accommodation. A good many members are asking the question why could not both conventions be held at the same place?

The difficulties experienced in making the Master Car Builders' rules of interchange of cars deal with all details of interchange become apparent whenever railroad men meet together and proceed to express their views. At best the rules are a series of compromises, and they require to be interpreted in a spirit of fairness. A difficulty of interchange which the rules do not provide for was mentioned by Mr. Schroyer at the last meeting of the Western Railway Club. The same thing is complained of in other districts. Mr. Schroyer said: "We receive a car from the Chicago, Burlington & Quincy in a damaged condition. It is damaged to the extent that the car is unsafe for service, and of necessity we have to take that car to our shops to repair it. In the transit of that car it is damaged very much beyond what it was when we received it, and in all such cases as this we have to stand the expense of the additional repairs on the car over and above what has been carded for by the Chicago, Burlington & Quincy or any other company delivering the car. That is an injustice which the Master Car Builders' rules do not provide for. In a great many cases we take those cars as a courtesy to the other roads, and repair them right here, because our shops are here and we can do it more easily than they could, and we lose a great deal of money on account of the additional damage of getting the cars to our shops. That is a thing which I think ought to be covered by the Master Car Builders' rules. Very often we take it up to the other road and sometimes they will compensate us, and very often they won't, and if they won't do it, we have to drop the matter and lose it."

New Publications.

STRENGTH OF BEAMS AND COLUMNS. By Robert H. Cousins, C. E. Published by E. & F. N. Spon, New York.

In this valuable treatise the ultimate and the elastic limit strength of beams and columns is computed from the ultimate and elastic limit, compressive and tensile strength of the material, by means of formulas deduced from the correct and new theory of the transverse strength of materials. Hitherto the calculations of the strength of beams and columns have been based on empirical rules and not on rational formulas deducted by scientists; and to remedy this is the work undertaken by the author in this book. The theories advanced, and the formulas resulting therefrom, deduce the strength of beams and columns from the direct crushing and tensile strength of the material composing them. The great practical benefits claimed for this establishing of correct scientific methods will be in the saving of material frequently wasted through being put unnecessarily into beams and columns. The work contains rather formidable mathematical formula, but it gives evidences of much faithful painstaking labor.

PRACTICAL BLACKSMITHING. Compiled and edited by M. T. Richardson, editor of the *Blacksmith and Wheelwright*. Published by the compiler.

This book consists principally of articles which have been contributed to the journal of which the compiler is editor. It contains a great deal of useful and interesting information on a subject about which surprisingly little has been written. The blacksmith has been the pioneer artisan of civilization, and his art has been in some periods and places the object of extraordinary adoration, yet we do not think that any work has been written recording the important part that the art of the blacksmith has exerted upon the world's history, or describing the varying grades of work produced by hammer and anvil. The book compiled by Mr. Richardson is not a very pretentious production, but it contains much that every one interested in blacksmithing will read with pleasure and profit.

Proceedings of the Master Car and Locomotive Painters' Convention.

Secretary McKeon, of the Master Car and Locomotive Painters' Association, has published, in a neat pamphlet, a report of the proceedings of the last convention of the Association, held at Chicago, in September last. The report contains all the papers read at the meeting and the discussions that they gave rise to. It will be found a useful and interesting reference for railroad officers. The papers read were unusually good. The report is carefully edited, but it contains no index, which is a serious defect.

Personal.

It is reported that Mr. Geo. W. Cushing, of the Union Pacific, has resigned.

Dr. Williams, of the Baldwin Locomotive Works, has started on a tour around the world.

Mr. W. H. Millman, railroad reporter of the Minneapolis *Tribune*, lost his life in a fire that burned down the newspaper building.

Mr. O. W. Wilson, master mechanic of the Southern Pacific, was drowned near San Diego, Cal., last month while making an examination of a washed-out track.

Mr. W. M. Greene, who has been for several years assistant to President Ingalls, of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed general manager of that road.

Mr. John W. Bracken, who recently resigned as master machinist of the Columbus & Western division of the Central of Georgia, has been presented with a gold watch by the employés under him.

Mr. James E. McNair, who has for a number of years been superintendent of the Louisville, New Albany & Chicago shops at Monon, Ind., has accepted the position of superintendent of the Ohio Falls Car Works, at Jeffersonville, Ind.

Mr. Samuel E. Dougherty, of Jersey City, was for some years master mechanic of the Camden & Amboy Railroad, and claims to be one of the oldest locomotive engineers alive. He is 77 years old. He is certainly one of the oldest master mechanics.

Mr. Charles Howard, who has been superintendent of the Providence & Worcester Railroad for about three years, has been appointed general manager of the New York & New England. Mr. Howard has gone through a varied and valuable railroad experience, and is an able and progressive man.

Mr. George H. Baker, who has written us many interesting letters on locomotive subjects, has been appointed mechanical superintendent of a railroad in Uruguay, being built by Baring Brothers, the famous London bankers. All the executive and operative officers of the road are to be Americans.

Mr. H. J. Kittendorf, superintendent of motive power of the New Haven & Derby road, died at New Haven, Conn., Dec. 13, after a long illness, aged 62 years. He was formerly for many years superintendent of motive power of the New York, New Haven & Hartford road, and was well known among railway men in New England.

General Lew Wallace, author of "Ben Hur," has invented a steel cross tie for railways. His friends claim that the tie is more perfect in its way than the story, and that it will "revolutionize railroad building." It occurs to us that we have heard this prediction made for other inventions that were "born to blush unseen and waste their sweetness on the desert air."

President Manvel, of the Atchison, Topeka & Santa Fe, made a tour of inspection over the entire system last month. While on the Pacific coast the train containing the inspection party made some particularly fast running. One stretch of 220 miles was run in 222 minutes. The engine that made this run was of the Stevens design and valve gear, with cylinders 17 × 26 inches and driving wheels 70 inches diameter. The train men said that better time would have been made had the track not been soft in places caused by recent heavy rains. The officials in the train did not consider that any apology was necessary. Some of them wished that the track was a little softer.

Mr. Thomas Aldcorn, master mechanic of the West Shore Railroad at New Durham, N. J., has recently invented and patented a ball and socket joint adapted especially for steam heat connections on passenger cars and locomotives, and it is now being successfully used. The device consists of a ball, socket, cap, spring, and nut or follower. The ball fits into the socket and is held in place by the cap, the socket being held against the ball by the spring and nut, which is screwed into the cap. The device will hold any steam pressure, and is so constructed that it cannot be screwed tight enough to prevent the ball from working freely. It requires no packing whatever, and is perfectly steam-tight.

The New York & New England has just put into use some new passenger cars of the most modern design. The finish is modest and not trying to the eye. Some of the peculiarities of construction are the use of double windows for the sides of the car, made of French plate glass; mineral wool lining between floors, and trucks with collarless axles 4½ in. by 8 in. The weight of these cars is about 66,000 lbs

Americans Built the First Successful Compound Locomotive.

We have lately received information which appears to show that the United States was the first country in which a successful compound locomotive was built and operated. About 1870 or a little earlier the Remington Company built at their works at Ilion, N. Y., some steam actuated suburban cars for the Worcester & Shrewsbury Railroad and one of them had the engines compound. The motors were used on a grade of 185 feet to the mile, and they worked very satisfactorily, but the compound was noted as being more powerful and much more economical on the fuel than the others. This machine had an upright boiler with a steam superheater on the top. There were two cylinders, one 5 × 12 inches, the other 8 × 12 inches, connecting with crank pins outside of the wheels, set at right angles. The cylinders were inclined about three-quarters of an inch to the foot. A common shifting link motion was used to actuate ordinary slide valves. Provision was made for using steam direct from the boiler in both cylinders when starting and when the work to be done was particularly heavy. When working live steam in both cylinders it was supplied through the steam chest for the high-pressure cylinder, and exhausted direct into the stack, each cylinder having been provided with an exhaust pipe that led to the atmosphere. When working compound the steam passed from the high-pressure cylinder through the superheater to a steam chest connected with the low-pressure cylinder, the superheater and steam chest acting as a receiver. Changing from simple working to compound was done by means of an intercepting valve which was located in the steam chest of the high-pressure cylider. This was a D slide valve. with ports in cylinder for the exhaust steam either to pass out to the atmosphere or to the receiver of the large cylinder, according to the position of the valve. When the valve was in position to allow the exhaust steam from small cylinder to go out to the atmosphere, the passage for live steam was open to the chest of the large cylinder, and when the valve was changed to send the exhaust steam into the receiver the passage for live steam was closed.

The motor was built after the design of the patentee, who also invented the Baxter engine. After working for several years the boiler failed, and the machine was taken to the Rhode Island Locomotive Works, where a new boiler was put in with submerged flue tubes. After this change the motor worked without the superheater part of the receiver, and was said to be still more efficient. It was at work till within a very few years. This information we have received through the kindness of Mr. D. A. Wightman, of the Pittsburgh Locomotive Works, and Mr. H. F. Colvin, of the Rue Manufacturing Company.

A Locomotive with a History.

The Adirondack company's pioneer locomotive, the Maj.-Gen. Hancock, is now utilized by the present owner, the Delaware & Hudson, at Saratoga Springs, as a steam generator to keep up the heat in the detached passenger coaches that are supplied with the McElroy system of steam heating. The old locomotive has a history, for it is a relic of Sherman's "Marching Through Georgia." It was originally built for service on a Georgia railroad in the antebellum days, and was afterwards drafted into the Confederate service, from which it was captured during Sherman's raid at the taking of Dalton. It was sent to Chattanooga and there sold at a government sale of confiscated rebel property, and was purchased by the late Dr. T. C. Durant, and used by him in hauling supplies in Tennessee as a government contractor. After the war he brought it North, and when as president of the Adirondack company he equipped its railroad, its whistle was the first to awaken the echoes of the upper Hudson at North Creek. It was used as a passenger locomotive at Saratoga Springs for about 20 years and has been twice rebuilt, but still retains portions of the original form and machinery.

How to Paint the Heated Parts of Locomotives.

The following paper on the above subject, by Mr. W. T. Hogan, master car painter of the Atchison, Topeka & Santa Fe, was read at the last convention of Master Car and Locomotive Painters:

"Having been assigned the subject of how shall we paint the heated parts of a locomotive to insure against cracking, blistering, scaling, etc., I will say that it is universally understood that a great amount of responsibility depends upon the primer. We have a great deal to contend with; such as intense heat and extreme cold, which produces expansion and contraction; hence it must be tenacious and elastic, and from personal experiments I would recommend the primer to be composed of two parts pure boiled linseed oil and one part of turpentine, made stiff with Prince's mineral and ground fine, thinned with turpentine, applied freely and well brushed out.

Second coat should be somewhat similar to the priming coat except that it is changed according to its office, which is to more thoroughly fill the pores and grain of the iron and unite itself solidly with the priming coat. It should be composed of one part pure boiled linseed oil and two parts turpentine, made stiff with Prince's mineral and ground fine, thinned with turpentine, applied freely and well brushed out.

Third coat for rough stuff should possess elastic toughness and unite itself solidly with the under coats, and be of a nature to cut down without clogging the stone; it is then absolutely necessary that it should be more or less porous, in order to rub well, but by no means should the pores be as large as the head of a pin, as I have often seen them, as it is disastrous to subsequent coats, owing to its extreme absorbing qualities, and it does not unite itself as solidly in a coarse state as it would were it ground moderately fine. It should be composed of two parts slow rubbing varnish and one part of best nonpareil japan made stiff with Prince's mineral and ground moderately fine, care being taken that it is thinned to its proper working consistency with turpentine, applied freely, and well brushed out, avoiding brush marks as much as possible. There is one great evil which I fear exists in many of our leading shops, which is the idea that rough stuff can be applied with any ordinary help, such as cleaners, etc., who, practically speaking, do not even know how to handle a brush. As a result we find it very uneven, full of brush marks, applied in a careless manner. If it were the amount of paint applied to a job that would add to its desirability I would most earnestly say pile it on; but the less paint we can get on and get the required surface and tint, the better results we attain, and in our estimation as much precaution should be exercised as with any coat of paint applied, which assertion I am positive many of my brother painters will corroborate.

Fourth coat, or second coat of rough stuff, should be composed of equal parts of varnish and japan, made stiff with Prince's mineral and ground moderately fine, thin with turpentine and apply.

Fifth coat, or third coat of rough stuff, composed same as second coat. Before applying add two or three handfuls of dry ochre, which will increase the speed of rubbing and also act as a guide coat.

Putty composed of two parts slow rubbing varnish and one part best nonpareil japan made stiff with Prince's mineral and ground fine; when ground up, adding equal parts of dry mineral and dry lead until it can be used without sticking to the fingers. When scraping in, soften putty with slow rubbing varnish, adding a little turpentine, care being taken not to apply any more putty or plaster than is absolutely necessary. Putty on first coat of rough stuff.

Preparatory coat for body color composed of one part slow rubbing varnish and two parts best nonpareil japan made stiff with Prince's mineral and ground fine, thin with turpentine and apply.

First coat of color; color should be ground in best nonpareil Japan; thin with turpentine and add one pint of slow rubbing varnish to every 20 pounds of color and apply.

Second coat of color; mix same as first, but add three-quarters of a pint of slow rubbing varnish to every ten pounds of color; when dry sandpaper lightly with No. 00 sand paper, care being taken not to stain color. The object is to remove all small nibs, and when varnished you have a very clean job.

I use a medium drying varnish that will dry free from dust in about six hours at a temperature of about 70 to 75 degrees; it, of course, is not as elastic as a slow drying varnish would be, consequently is not as sensitive to steam, smoke, draught, etc., which we are apt to have to contend with in varnishing locomotives.

Time required:

	Days.
Priming	2
Second coat	1
First coat rough stuff	1
Putty	1
Second coat rough stuff	1
Third coat rough stuff	1
Preparatory coat	1
First coat of color	1
Second coat of color	1
First coat of varnish	2
Second coat of varnish	2
Total	14

No doubt you have noticed I do not use any japan or dryer of any kind in my former coats of paint. My object in doing so is to obliterate so far as possible any element that tends to crack or peel. It is a well known fact that the ingredients that go to make up a dryer have been a source of great annoyance to our fraternity, and in securing the required results without this aid is a benefit which experience has taught me to be of great value. You can reduce the time of painting to nine days by plastering on first of rough stuff, sanding, kalsomining and repeat, varnishing if necessary.

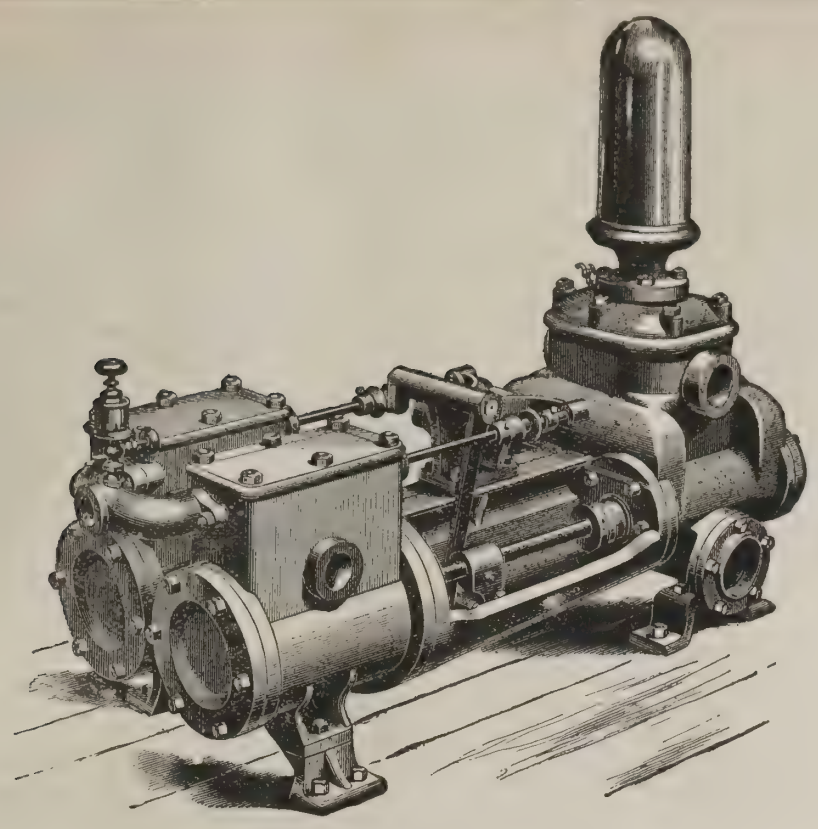
The Magnolia Anti-Friction Metal Company claim that their metal, when used as bearings, puts a thin enamel on the journal, which reduces friction and prevents it from wearing.

The Fox Solid Pressed Steel Company are meeting with great success in the steel products they are offering to railroad companies for car and locomotive work. There are already 1,500 cars running with steel center plates.

The Ohio Falls Car Company, Jeffersonville, Ind., have recently added to their works one of the largest saw-mills in that part of the country, capable of cutting 50,000 to 60,000 feet of hard wood lumber per day. They are full of work in both passenger and freight departments.

The Marden Car Brake Company, of Boston, Mass., are busy, having recently received several orders for their steel brake beams, among them one of 1,000 for a Western railway company. Mr. W. O. Sheldon, who was formerly their secretary and treasurer, has resigned, to engage in the lumber business in the South. Mr. O. H. Rogers has succeeded him.

Wood-working machinery is still more extensively made in Cincinnati, O., than ever before. The Egan Company, manufacturers of wood-working machinery, are now building a large addition to their already extensive factory. Their new building will front 180 feet on West Front street, and run back 100 feet on John street to Greenleaf. This addition to their works will be four stories high, and will be the most advanced type of building in the United States for their class of work. This will give the Egan Company a whole square right in the heart of Cincinnati, and gives them the largest and most extensive plant in the world for the manufacture of improved tools for wood work.



THE VALLEY DUPLEX STEAM PUMP.

The duplex steam pump, illustrated above, differs from others of its class in the manner adopted for moving the steam valves. It will be noticed that instead of the link commonly used for moving the steam valves in duplex pumps, a straight rod is substituted without any joints. On it are two collars held in place by set screws, which can be adjusted to lengthen or shorten the stroke. Between them is a spool, loose on the rod, which is moved by the crank of the rock shaft until it comes in contact with one of the collars, when the valve is carried along and the pump reversed. It is claimed that this arrangement works easier, and is more durable than that employing links, as the joints made by the crank pin and the flanges of the spool are the only part to wear. The surfaces being large, and the spool having a rotary motion, the wearing away by use is reduced to a minimum. The Valley Pump Company, Easthampton, Mass., are the manufacturers.

Mr. James Butler, while in Philadelphia lately, drew an accident ticket, costing 15 cents, out of one of the Employers' Liability Assurance Company's automatic boxes, and a few minutes afterward he was thrown by accident out of a street car and seriously injured. He received $750 from the insurance company.

Most of the railroad men interested in machine tools are acquainted with the catalogue that the Brown & Sharpe manufacturing Company, Providence, R. I., publish to describe and illustrate their machine tools. That catalogue, although convenient for the pocket, is too small for holding cuts that will do justice to fine tools, and evidently on account of this the company have just issued a supplement with a page 6 × 9 inches to illustrate the most important class of machines. The work is admirably done and does justice to the fine machines manufactured by the company. Besides giving excellent perspect ve views of the machines there are drawings illustrating important operations done by the tools. The supplement is sent to any applicant on receipt of 15 cents.

The Ashcroft Manufacturing Company, Liberty street, New York, have published a new hand book on the Tabor Indicator. The work has been very carefully and intelligently prepared and will be found a useful manual for engineers using the indicator or interested in steam engineering. The book can be had free by engineers on application to the firm. It ought to be in every engineer's book case.

Mr. R. L. Peck, chief engineer of the steamer "Owego," writes as follows to the Magnolia Anti-Friction Metal Company: "I take pleasure in giving you a record of the use of Magnolia metal on the steamship 'Owego.' The 'Owego' is 2,500 tons burden, has triple-expansion engines, 3,000 horse power; high pressure, 28 inches diameter; intermediate, 42½ inches diameter; low pressure, 72 inches diameter, and has 4½ feet stroke pistons; main shaft, 14 inches diameter. The Magnolia metal was used in low-pressure crank-pin brasses, 14 inches diameter, 16 inches long. Your metal was placed at quite a disadvantage. Post's zero had melted out the first trip used in this bearing, and it was well cut upon the surface. Was in a great hurry, and did not have time to run the Magnolia metal as I should like to have done. The first trip to Buffalo, Aug. 1, I intentionally let the bearings run loose, and there was a great deal of pounding upon the Magnolia metal. I took this precaution because Post's metal had melted. I expected to see the Magnolia metal all used up upon examination in Buffalo, but was surprised and gratified upon the examination. I keyed the brasses up, and the chill has not since been off the brasses, although we have encountered weather that would lift the propeller wheel out of the water. These facts are taken from my log record, and you are welcome to them.

The Cowell Platform and Coupling Company, of Cleveland, O., report their business as growing very rapidly. They never were so busy before. Their buffer and coupler is used on all vestibule cars, and some of the most prominent railroads in the country are now adopting it on their passenger coaches, as it makes a continuous floor from one car to another.

The Consolidated Car Heating Company, of Albany, has absorbed the Automatic Car Coupler Heating Company, of Detroit, Mich., and has acquired the ownership of the "Peerless Coupler" and other valuable appliances.

The Long & Allstatter Company, Hamilton, O., are extremely busy making their specialty of power punches, shears and hammers, and to accommodate their increasing business they are adding a story to their main building. The building is 60 × 200, and the improvement will make it four stories high.

The Jackson & Woodin Car Company, Berwick, Pa., are very busy in all the departments of the car shops, forge, foundry, rolling mills, pipe mills, etc. They have recently received an order for 500 cars for the Lehigh Valley Railroad, and several other orders, which will keep them busy for some time.

The Lehigh Valley Car Company, at Stemton, Pa., are unusually busy. Among the orders they have on hand are cars for the Pennsylvania, Poughkeepsie & Boston Railroad, the Eutawville Railroad, of South Carolina, the New Jersey Central, the Lehigh Valley, and some for some South American railroads.

The Milton Car Works, at Milton, Pa., are completing an order for 100 60,000-pound hopper-bottom gondola cars, and have on hand orders for a number of cars for the Lehigh Valley, New Jersey Central Railroads and some for Havana, Cuba.

The Lehigh Valley Railroad, in addition to the 2,000 cars they have just ordered, are building at their own shops 500 box, 200 coal and 200 F. B. gondolas.

Messrs. A. W. Whitney & Sons, of Philadelphia, Pa., are very busy keeping up with their orders, their wheels showing their usual good record. Out of 5,000 which were tested recently by the R. W. Hunt Inspection Company, over 4,500 did not vary ⅛th of an inch in circumference.

The Rochester Car Wheel Works of Rochester, N. Y., are turning out 150 wheels per day, using the Barr contracting chill. It is a very unusual thing for them to have a chill crack, or blemish of any kind—in fact they seldom have a wheel condemned for any reason. Their wheels are giving increased mileage, and the demand for the Rochester wheel is growing very rapidly.

Wheels made by The American Steel Wheel Company, of Boston, Mass., are now no longer an experiment; they are used on every railroad that leads out of Boston, as well as on a number of roads outside of New England. This wheel has proved to be sound and strong, as evidenced by some remarkable tests in pressing on axles, in some cases as high a pressure as 90 tons having been used without injury to the wheel. A large number of them have shown an actual mileage of 250,000 miles without being turned, but in some instances only a slight dressing with an emery wheel, and are in the opinion of the railway officials, good for another 250,000 miles' service.

The Buffalo, Rochester & Pittsburgh will soon be in the market for a number of box cars. They have built one as a sample, and intending bidders will be required to examine it before making bids.

The Bellmeyer & Small Car Co., of York, Pa., are busy on some day coaches for the Norfolk & Western, Atlantic & Danville and several other roads, as well as a number of freight cars. They are also building cars for railroads in Cuba and Mexico.

Messrs. Dorner & Dutton, of Cleveland, O., who have taken the Street Railway Department of the Cleveland Foundry, are building up a large trade, exceeding their expectations. In addition to the large part of the foundry set apart for their use, they have had to take in another building, 80 × 100 feet, and have fitted it up with the latest improved machinery.

The Samson Cordage Works, Boston, have sent out cards containing specimens of the braided cords of various colors suitable for bell ropes and similar purposes. The cords are very neat and compact, and are reputed to be extremely durable. The durability of these cords is reported to be much increased by a special process of waterproofing.

The two factories of Stewart Hartshorn, one in East Newark, N. J., and one in Muskegon, Mich., are working full capacity to fill the orders on his well-known self-acting shade rollers. Enlargements of both factories are in progress, and many improvements in construction are proposed that will add to the merits of the rollers that have become universal. With thirty years' experience, and the determination of producing only perfect goods, the trade know that the consumer will be satisfied when sold the old reliable.

Messrs. F. W. Bird & Son, of East Walpole, Mass., are meeting with good success with their rope roofing paper, having received several orders for it for car roofs, also for the roofs of depots and shops. They also manufacture insulating paper, to be used in refrigerator cars and cold storage warehouses. Several railroad and refrigerator car companies are using it quite extensively.

The Bridgeport Machine Tool Works, of Bridgeport, Conn., have recently issued a very handsome catalogue, containing photographs and descriptions of the different machine tools that they manufacture, such as heavy screw machinery, lathes and boring machines, and other kinds of metal-working machinery. They are quite busy with several large orders on hand.

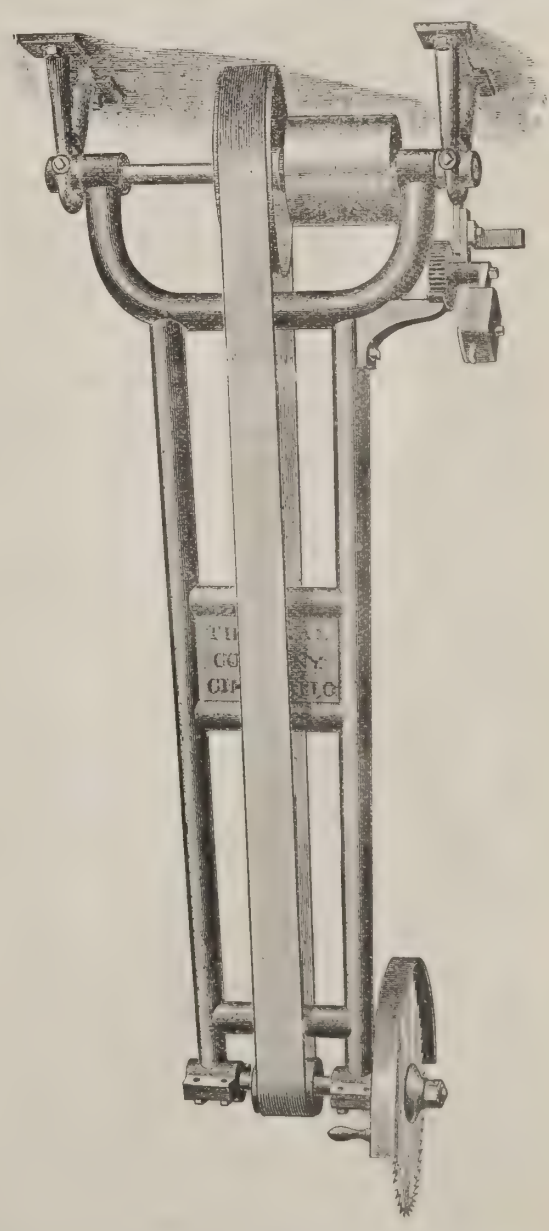
The Atlas Bronze and Tuyere Company, Limited, of Pittsburgh, Pa., finding that their old foundry was not large enough for their rapidly increasing business, have recently erected a large building of brick and sheet iron, 72 feet front by 120 feet deep, containing eight large furnaces.

Cast Frame Swing Saw.

The new cast frame swing saw we illustrate, it will be readily seen, has many points of excellence. It is made standard size to suit the average height of ceiling, and the frame is very stiff and well braced, and especially designed for heavy and wide stock and quick work.

The improved compensating or balance weight is applied in a new manner, and in such a way as to counterbalance the weight of the frame, giving it a very light, quick motion, and making it very easy on the operator.

The hangers are very perfect, the frame swinging on the



outside of turned sleeve boxes, and the countershaft runs inside of these boxes or sleeves, making it impossible to get out of line, as the frame does not hang on the countershaft, but on the boxes of the hangers. The pulley on the saw mandrel is extra large and the mandrel boxes are lined with genuine Babbitt, and are self-oiling.

The patent shield covering the saw prevents any possible accident to the operator.

Further particulars and prices may be had by addressing the manufacturers, The Egan Company, 235 to 255 West Front street, Cincinnati, O.

In giving the description of the Tripp Anti-Friction Journal Bearing in the December number of this paper, we omitted to mention where it was manufactured. It is made by the Tripp Manufacturing Company, 33 India Wharf, Boston, Mass.

The works of the Straight Fiber Iron Company, of Chicago, were completely destroyed by fire about one year ago. They have lately been rebuilt and greatly enlarged. Iron buildings have been substituted for wooden buildings, new machinery has been added, and the company reorganized and re-officered. The plant as now equipped is modern and complete. The specialties are high grade merchant iron and the "Straight Fiber Car Axles." The works are located at Fortieth street and Stewart avenue, and their capacity is 100 tons of bar iron per day. One hundred men are employed The present officers of the company are J. McGregor Adams, President; Walter L. Lee, Vice-President and Manager; D. P. Donelson, Treasurer; F. Newell, Secretary, and M. C. Williams, Superintendent. The office of the company is 769 The Rookery.

The Schoen Manufacturing Company of Philadelphia whose business is the manufacture of articles in pressed steel for railway equipment, have decided to move their plant to Pittsburgh. The capital stock of the company has been increased to three hundred thousand dollars, and they are now engaged in erecting fireproof iron buildings in Pittsburgh, and have made their contracts for a complete plant on the hydraulic system. Everything is to be first class, and they will have the capacity to turn out from 40 to 50 tons per day of the articles they manufacture. Mr. C. T. Schoen, of Philadelphia, is the president, and Mr. Henry W. Oliver, of Pittsburgh, is the vice-president of the company. The works will be located adjacent to those of the Oliver Iron & Steel Company.

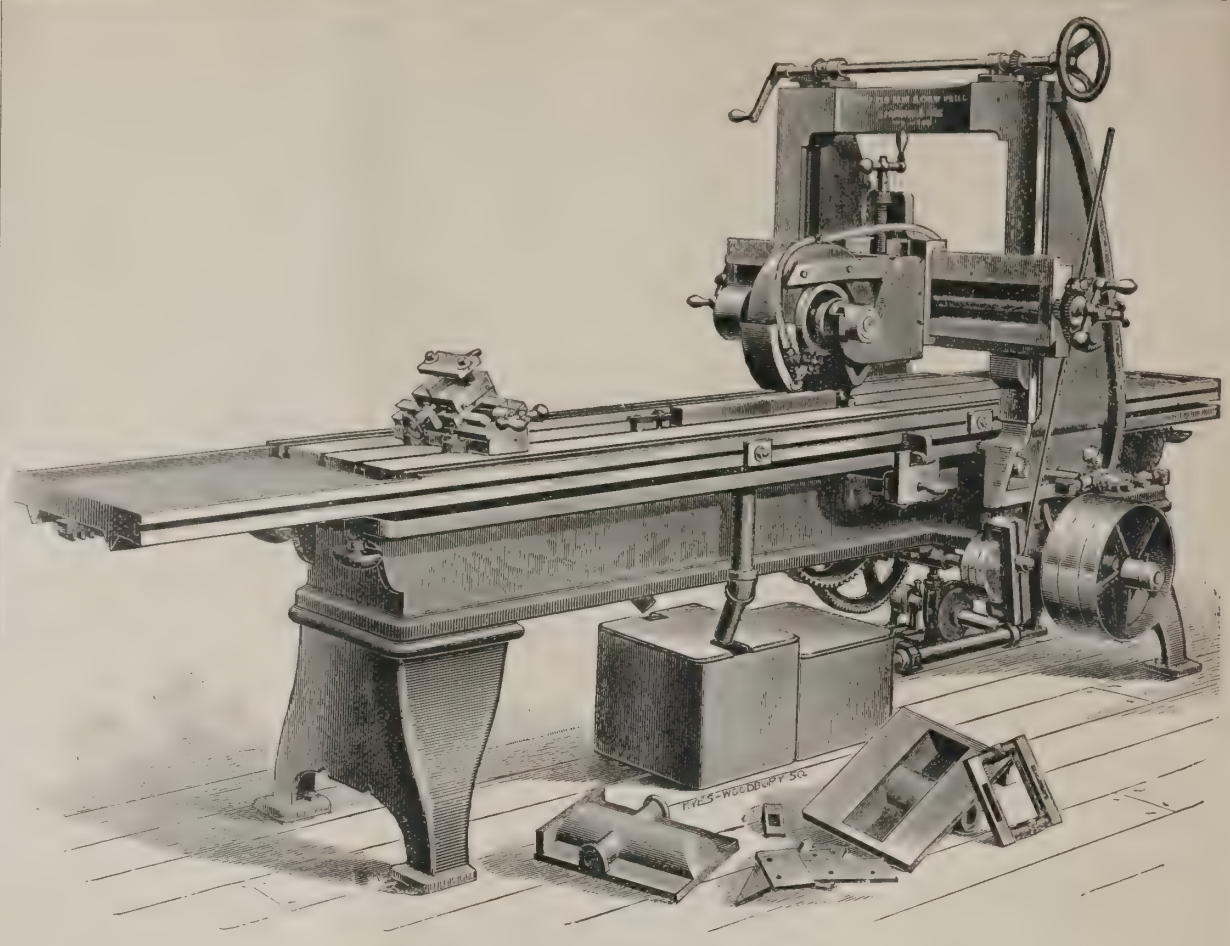
Messrs. H. W. Stone & Co., Morris, Minn., in a communication to Messrs. Westinghouse, Church, Kerr & Co., of Chicago, say: "The 8 and 13 × 8 compound engine we bought from you is now running day and night. We are not only satisfied with it, but are also very much pleased with it. On a test run of ten hours, with your Mr. Finch firing, we used but one cord of basswood, equal to one-half cord of maple, grinding in that time twenty-five barrels of flour. This we consider good economy from any engine using steam from a common tubular boiler and without condenser; but had our mill been equipped with the light-running machinery now commonly used in mills the size of ours, we are confident the flour output would have been at least one-third greater with the same amount of wood. Continue to send into this State such engines as you have sent us, and such men as Mr. Finch to start them, and your trade will increase rapidly in this section."

We learn from the Valentine Varnish Company, New York, that at the Paris Exhibition the four carriage makers that received the grand prize had their exhibition carriages finished with Valentine varnish. More than one hundred of the carriages shown at the Exhibition were finished with this varnish.

The Electric Car Company of America, at Twenty-third street and Washington avenue, Philadelphia, use at their experimental station a 25 H. P. Otto engine for charging accumulators, and recently kept it going continuously for 60 hours, day and night. The little attention required for gas power makes it possible to use it with little cost for attendance at nights, and makes gas power for day and night work exceptionally desirable. Besides, where producer gas is used, instead of coal gas, the cost of fuel sinks to 1¼ per cent. of coal, as has often been reached on continuous practical work where producer gas plants are in use. For electric car stations the Otto gas engine should, therefore, have a bright future and increasing sale."

The Safety Car Heating and Lighting Company informs us that the company has gas works in operation in New York and Chicago for the manufacturing of the Pintsch compressed oil gas for lighting passenger cars, now being extensively used by the Pullman and Wagner palace car companies, and by the New York Central, N. Y. & P., Erie, West Shore, Chicago & Atlantic, Wabash, L. N., A. & C., C., H. & D., Boston & Albany and other railroads. Gas works are also being constructed, and will soon be completed in Boston and St. Louis. The plant for works are also being made by the Pintsch Company, in Berlin, for Cincinnati, Indianapolis, Communipaw, Kansas City, Buffalo, Denver, Ogden and Council Bluffs, and these works will be in operation within six months. The demands for the Pintsch gas light by the railroads is increasing very rapidly.

The Dunham Manufacturing Company announce that they have recently remodeled, improved and strengthened their former equipment of the Dunham door in every point (keeping, however, all parts interchangeable with former equipment). First, the hanger is three times stronger and stiffer than before; wheels are to be malleable instead of gray iron, with materially larger and longer journal or axle. The track is at least four times the strength and thickness of that formerly used and the side fastenings are double in strength. Entire new features in fastenings have been added in one of the simplest and most efficient forms of car door fastenings ever shown. It is a double-working cam, to be fastened to the vertical door strip where, by turning the fastener to the left, it facilitates the initial opening of the door, or reverse movement, closing the door easily, and the same motion forces the door tight against the door post. We have also added an automatic gravity dog at the two bottom corners of door to engage with the bracket guide. When a car is started in motion, with the door carelessly left open unfastened, it must of necessity (running so easily) become fast, either fully open or closed; eliminating the only objection ever found against our door, as some have ought it worked too easy



EMERY WHEEL SURFACE PLANER.

This machine is especially adapted for surfacing iron in the rough, where but a small amount is to be taken off, and for finishing or cutting down work where the material is hard, as chilled rolls, steel dies, punches, etc. On tempered work it saves drawing the temper and rehardening, and the work is true when done. It is also adapted to finishing work that has been roughed off on a planer where it is desired to take out the tool marks. The emery wheel cuts as fast when the carriage is running backward as when forward, and it will grind freely the very hardest castings. Castings have to be made only a little above the the actual size they wish to finish, as the surface planer only needs to remove enough stock to bring the work to a nice finish. The work can be fastened to the carriage by the ordinary method used on iron planers. A folding hood nearly surrounds the wheel, which prevents the water flying off, and is adjustable to the wearing away of the wheel. A centrifugal pump is attached to each machine, piped with valve to regulate the flow of water on the wheel. The water is taken from a tank on the floor under the machine. A channel on each side of the carriage catches the water and conducts it through holes drilled at the bottom of the channels, midway between the ends of the carriage to the troughs cast into the side of the planer beds. An iron pipe on back side of machine conducts it from the troughs to the tank under the machine, where the sediment settles, and comparatively clean water overflows from the top of this tank into a second one, where the pump takes it, using the water over and over. The pump furnishes a large supply of water, which prevents heating and drawing of the temper and gives a fine finish, and the grinding can be done much faster as a consequence. Moreover, it prevents loose emery flying on to the working parts and on to the neighboring machinery. The machine has an improved system of idlers, to be fastened to the ceiling, for keeping the belt that drives the wheel at a proper tension. As the emery wheel is raised or lowered for work of different thicknesses the idlers are run in and out by a system of bevel gears, and crews operated by hand screws within easy reach. It is provided with a patent belt shifter for the carriage motion, which is arranged to start the belt enough in advance of the other to prevent all screeching of the belts when reversing the motion of the carriage. The machine is made in six different lengths respectively, taking in work of 4, 9, 12, 15 and 18 feet long. This machine is built by the Springfield Emery Wheel Manufacturing Company, of Springfield, Mass.

The Middletown Car Works, Middletown, Pa., are full of work, as also are the works of Schall & King, at York, Pa., having to work extra time.

The National Paint Works of Williamsport, Pa., have done a particularly large business lately, a great portion of it having been for car and bridge work. Among recent orders were the Pennsylvania Railroad for car work; the Denver Cable Railroad Company for cars; the Thames River Bridge, New London, Conn.; the New Chesapeake & Ohio bridge at Cincinnati.

The Capitol Manufacturing Company, Chicago, have published a new illustrated catalogue showing the bolt-threading and nut-tapping machinery manufactured by the firm. The first prize for a bolt-threading and nut-tapping machine was awarded at the Paris exposition for the leading machine shown in the Capitol Manufacturing Company's catalogue, which is a significant indication of the merit of the machine. The company make out an excellent case for the superiority of the Adams threading head, and numerous testimonials from manufacturers using the machine corroborate the justice of the claims put forth. The machines are made of steel throughout, perfectly fitted, and designed to secure accuracy of operation and great durability.

The Ironclad Paint Company, of Cleveland, O., are busy, as usual, there being a growing demand for their metallic paint, which is so favorably known wherever used.

The Michigan Railway Supply Company, of Detroit, Mich. are doing a large business with their Improved Central Steel Brake Beam. It is used on quite a number of railroads. They are also making a corrugated steel grain door.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge of any error that may be noticed in our list.

American Midland R. R.—John P. Carrothers has been appointed receiver under an order of the United States Court for the Northern District of Ohio.

Atlanta & West Point.—Captain E. L. Tyler has been appointed general manager of this road, and of the Western of Alabama and Cincinnati, Selma & Mobile lines, with headquarters at Montgomery, Ala.

Central of Georgia.—John H. McGill has been appointed master mechanic, with headquarters at Atlanta. Jere Whitselt has been appointed master mechanic of the Columbus and Western division.

Central New England & Western.—Mr. John Hawthorne has been appointed master mechanic of the shops at Hartford, Conn.

Chicago & Northwestern.—R. A. Cowan has been appointed superintendent of the Madison division of the road, vice G. F. Bidwell, resigned.

Columbus, Hocking Valley & Toledo.—James Bruce has been appointed superintendent of the Toledo division, with office at Toledo, O.

Des Moines & Northern.—Mr. L. M. Martin has been appointed general manager, with headquarters at Des Moines, Iowa.

Kentucky Union.—Patrick Ryan has been appointed master mechanic, with headquarters at Winchester, Ky.

Louisville & Nashville.—Donald Allen, superintendent, has resigned.

Louisville Southern.—James D. Carson has been appointed superintendent of the road at Louisville, Ky.

Mexican National.—T. D. Kline, superintendent, has been promoted to the position of general manager, vice Major O'Brien, resigned.

Milwaukee, Lake Shore & Western.—Mr. George F. Bidwell has been appointed general superintendent, to take effect Dec. 1.

Mineral Range.—C. A. Wright has been appointed general manager.

Mobile & Ohio.—Z. T. Ferguson, master mechanic, has resigned.

Ohio, Indiana & Western.—D. J. Peffers has been appointed purchasing agent at Indianapolis, Ind., to succeed Hunter Gunnell, resigned.

Ohio Southern.—A. E. Tremp has been appointed master mechanic, with office at Springfield, O., vice John King, resigned.

St. Joseph & Grand Island.—A. J. Broughel has been appointed master mechanic, with headquarters at St. Joseph, Mo.

Texas Trunk.—J. D. Tramwell, engineer, has also been appointed superintendent at Dallas, Tex., to succeed J. J. Kertin, resigned.

Texas Western.—Mr. John H. Gray has been appointed general manager.

Toledo, Ann Arbor & North Michigan.—J. B. Conners has been appointed superintendent of this company's lines, with headquarters at Owosso, Mich.

Union Pacific.—G. M. Cumming, general manager of the Mountain Division, with headquarters at Salt Lake, has resigned, and C. F. Ressiquie has been promoted to the position.

Zanesville, Mt. Vernon & Marion.—Col. Boone, general manager, has resigned.

NATIONAL CAR AND LOCOMOTIVE BUILDER

FEBRUARY, 1890.

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Barney & Smith have booked an order for eight new cars for the Wagner Co.

The B. & A. and B. & Maine are about to place orders for several hundred freight cars.

The New York, Susquehanna & Western Railroad are in the market for six coaches, four cabooses and 100 box cars.

The Chesapeake & Ohio Railroad Co. has ordered 10 locomotives, weighing 65 tons each, of the Richmond Locomotive Works.

On some of the Belgian and German railways where the Stevens rail is used without chairs, they put a plate like the Servis tie plate to prevent the rail from working into the tie.

The Staten Island Rapid Transit are in the market for 20 passenger cars and 5 engines. This equipment is believed to be for service on the new connection with the New Jersey Central.

Master Mechanic McKenna, of the Indianapolis, Decatur & Western, some years ago put in yellow pine to replace the paper centers in some wheels that had gone through a fire. Since this change was made the wheels have run 200,000 miles and worn out the tires. The question now agitating some of the car men about Indianapolis is, "Will yellow pine be the future material for wheel centers?"

The New York, Ontario & Western have lately ordered 16 passenger cars, to be built at Wilmington, Del. They are for ordinary day train service, and will be supplied with all the comforts and conveniences necessary for a first-class service. They will be heated with steam from the locomotive, and lighted by the Frost system. The wheels are specified to be steel tired, 42 inches diameter.

The Lehigh Valley Railroad is about to apply the Westinghouse quick-action automatic freight brake to 2,500 of their cars. One important feature of this order is the fact that it is from an Eastern road. Heretofore the larger percentage of brakes have been applied to the equipment of the roads west of the Mississippi River. The Pennsylvania Railroad has about 10,000 cars fitted with brakes on their lines east and west of Pittsburg.

Among recent lawsuits against railroad companies worthy of notice was that of John Olsen against the St. Paul & Duluth road. Olsen, it was shown, was stealing a ride on a freight train and in an accident lost his leg. He pretended in the suit that he was in charge of a car of horses, but the railroad company had given him no authority to be there. He sued for $20,000 damages, and a granger jury in Stillwater, Minn., gave him $10,000.

The Supreme Court of the State of Pennsylvania has decided that a railroad company has the legal right to make an extra charge of 10 cents when passengers pay their fare on the cars when the railroad company provides the necessary facilities for the supply of tickets at stations. This decision will, no doubt, to a great extent curtail the practice of paying fare to conductors. There will continue to be exceptions, however, as in the case of a Western coal dealer, who considered himself aggrieved by a railroad company, and vowed that no railroad company should ever get another cent of his money. As a means of carrying out his resolution he always paid his fare on the cars, in the perfect assurance that the money would not reach the coffers of the railroad company.

The Louisville & Nashville Railroad Company (office, Louisville, Ky.) has ordered 20 locomotives from the Rogers Locomotive Works, Paterson, N. J. Ten of these are consolidated engines and ten switch engines.

Drexel, Morgan & Co., bankers, New York, are reported to have awarded to Wells, French & Co., car builders, Chicago, the building of 500 freight cars for some road they are interested in. It is expected that orders will soon be given for 1,500 more cars of the same kind. Those ordered are the standard pattern used by the Big Four Company.

What constitutes a drawing room car? or wherein are the drawing room cars of the New York, New Haven & Hartford different from their day coaches? Patrons are frequently in a quandary on this question. Windows are no larger. Interior finish, excepting a skimpy portiere and the most uncomfortable of chairs, is the same. And so far as bears on the last 10 cars put in service last spring, they are the worst riding cars on the road, being noisy and jerky. Who is at fault?

Nominally a carload continues to be 20,000 pounds. It is also 70 barrels of salt, 70 of lime, 90 of flour, 6 cords of soft wood, 18 or 20 head of cattle, 50 or 60 head of hogs, 90 or 100 head of sheep, 8,000 feet of solid boards, 17,000 feet of siding, 13,000 feet of flooring, 40,000 shingles, one-half less of hard lumber, one-fourth less of green lumber, one-tenth less of joist, scantling and other large timbers, 340 bushels of wheat, 400 of barley, 400 of corn, 680 of oats, 360 of flax seed, 360 of apples, 340 of Irish potatoes, 380 of sweet potatoes, 1,000 of bran. It is generally as much more as the shipper can get sneaked in without extra charge.

There has been a fierce conflict raging for some time between several railroad companies and the courts regarding a law passed three years ago by the Legislature of Alabama, requiring all railroad employés to be examined by a physician for color blindness, the railroad companies to pay the expense of the examination. The law was notoriously a piece of class legislation, its object being to permit certain doctors to rob railroad companies under regular process of law. It is right and proper that railroad men having connection with signals should be examined to see that their vision is good; but the test can be carried out just as satisfactorily by a trainmaster or master mechanic as by the ordinary physician. Common doctors know no more about diseases of the eye or visual defects than non-professional men; and to put into their pockets a fat fee for making a test for which they have no special skill or ability is merely giving something for nothing.

A passenger on a Canadian Pacific train tells of the following thrilling accident to the through express train in the mountains: "A rail gave way at a point on the mountain side high above the Columbia River. The engine passed over safely, but two coaches following swung about and toppled over. The bank there was very perpendicular, and the cars would have tumbled several hundred feet below into the flowing river had it not been that the coupling twisted around and held the tremendous weight. There were the two cars, one with its load of passengers, suspended between heaven and earth. The weight of the engine and the rest of the train prevented the suspended cars from drawing the whole train down. The suspense was dreadful. The frightened passengers were compelled to remain in their perilous position until train hands built a platform around and underneath the hanging cars, enabling all to make their escape. The place where the accident occurred is considered the most dangerous in the mountains."

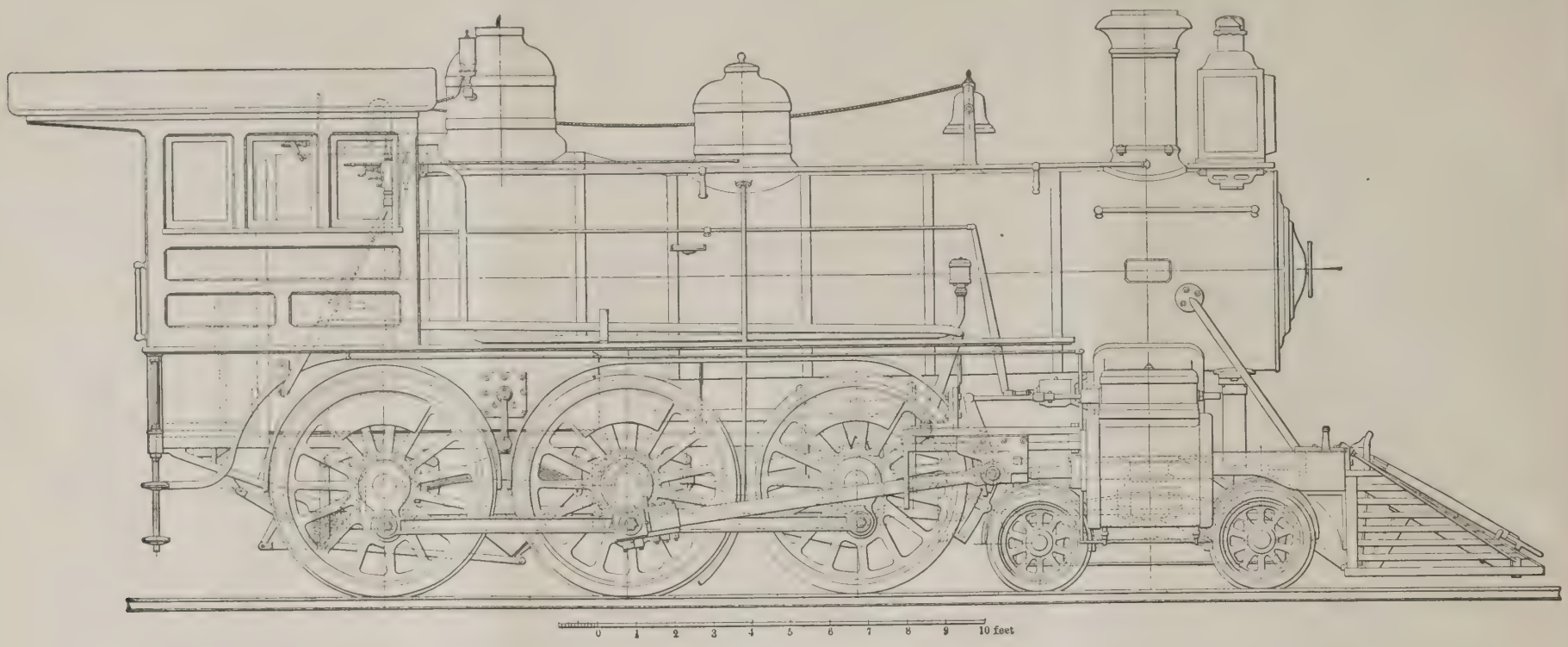
Very serious charges have been lately brought against the authorities of the London & Northwestern Railway in charge of the great works at Crewe, and Mr. Gladstone has thought the subject worthy of special notice. The charges are, that for nine years past these officials have used their official influence to intimidate and punish prominent Liberal workmen in the railway works, so as to secure the supremacy of the Tory party in the town. That they have dismissed, and are continuing to degrade and dismiss some of the best workmen for no known reason, except that they are prominent Liberals. The interests of the shareholders are thereby made to suffer to serve party ends. That it is exceedingly rare for any man who has prominently supported the Liberal cause to be promoted, and that, though there are a number of Liberal foremen, not one of them has been allowed, of recent years, to appear on a Liberal platform. That during the last few weeks several prominent Liberals of the highest character have been discharged. Mr. William Urquhart, the secretary of the Liberal Club, after 33 years' service, has been dismissed without any reason being given; and Mr. Joseph Jones, president of the Crewe Liberal Association, after 32 years' service in the works, has been so badly treated that he has had to leave. The truth of the charge is denied by Mr. Webb, the head of the department, but the Liberal members of the Town Council of Crewe have called upon the shareholders of the company to insist upon a thorough investigation.

There are many nervous people in the country who are constantly predicting ruin to important interests through the cutting down of our forests, but those who have made a special study of timber supply assert that there is no fear of our forests becoming extinct. An authority on the subject says that the greatest danger to forests is from the starting of fires, and he favors stringent regulations regarding the starting of fires by locomotives and by people who go hunting or camping in the woods. The cutting of trees, he declares, is an act in accord with nature, and, as soon as they are destroyed, others grow in their place. It is true that certain kinds of timber are becoming extinct, just as certain animals which formerly walked the earth are now known only by their skeletons. But other kinds of trees spring up, and there isn't, he maintains, any likelihood of an absence of supply for one or two centuries at the very least.

The newspaper men of Michigan became so excited about the new compound locomotive at work on the Michigan Central, and the inquiries about the working of the engine poured in so persistently to the officers of the company that Assistant General Superintendent Robt. Miller decided to put his private car on a fast passenger train pulled by the engine and invite the newspaper men most interested to take a ride with him. Among others who joined the party were Mr. A. J. Pitkin, superintendent of the Schenectady Locomotive Works, the designer and builder of the engine, and Mr. Henry Schlacks, motive power superintendent of the Illinois Central. The engine made a splendid run with a heavy train and the newspaper men spread themselves. Among the statements made was that the principal difference between a common and a compound locomotive was that a compound had two cylinders and a common engine had only one. This reporter informed the readers of the paper that they had a highly distinguished engineering company on the trip, among whom were Mr. A. J. Pitkin, traveling engineer of the Schenectady Locomotive Works, and Mr. Henry Schlacks, inventor of the compound locomotive. The engine started so quickly with a train that several brakemen who had paused to watch the peculiarity of the single exhaust had not been able to jump on when they attempted to get on board the train.

The investigation developed one custom of railroads, says the third annual report of the Interstate Commerce Commission, that seems to be general and to rest on considerations that have no little force. This is the custon of giving free transportation or reduced rates to families of subordinate employés. It is obvious that, for many forcible reasons, the most amicable relations should exist between the railroad companies and their employés, and that the latter should feel that the companies are disposed in all proper ways to manifest an interest in their general welfare. The compensation of these employés is low, the service exacting and often hazardous, their opportunities to give attention to domestic affairs are very limited, and as a rule they are dependent almost entirely on their compensation for the support of their families. It is clearly for the interest of these employés to reside at points on their roads convenient to their business, where homesteads can be acquired and cost of rents and living expenses are moderate. Such locations may often be some distance from points required to be frequently reached by members of their families, such as schools and markets, and it would seem reasonable, and no more than an equitable part of their compensation, for the company to carry the wives and children of their employés free, or at low rates, for fairly necessary purposes. Provision, it would seem, might very properly be made to permit this to be done.

Getting caught between the bumpers of cars while coupling them together is the commonest of mishaps to railroad men, but James McCann, a brakeman in the employ of the Western New York & Pennsylvania Railroad at Olean, was made the victim of the bumpers one night last month in a manner which is unparalleled in the history of railroad mishaps. He was coupling cars in the yard at Olean at about 9 o'clock in the evening. The weather was intensely cold. In coupling the cars together his hand was caught between the bumpers. The engineer, not knowing that anything was wrong, pulled away his locomotive, being a switch engine, and its work being finished with the backing down of the cars to the one McCann was to couple to. The cars were on the outskirts of the yard, where they were to remain until the next morning. McCann was pinned fast between the two bumpers, and to extricate his hand, which was crushed to a pulp, was impossible. He shouted for help, but no one heard him. The agony he suffered from his mangled hand was indescribable. For three hours he was held between the cars, when he became unconscious from the effects of his injury and exposure to the cold. Soon after midnight a night track laborer, who was returning home from his work passed near the cars where McCann was a prisoner, and hearing moans, discovered the injured and freezing trainman. The laborer summoned help, and the cars were pried apart and McCann was removed to the station. He was badly frozen and his hand was so terribly mangled that it had to be amputated. McCann is not expected to recover from the effects of his terrible night's experience.



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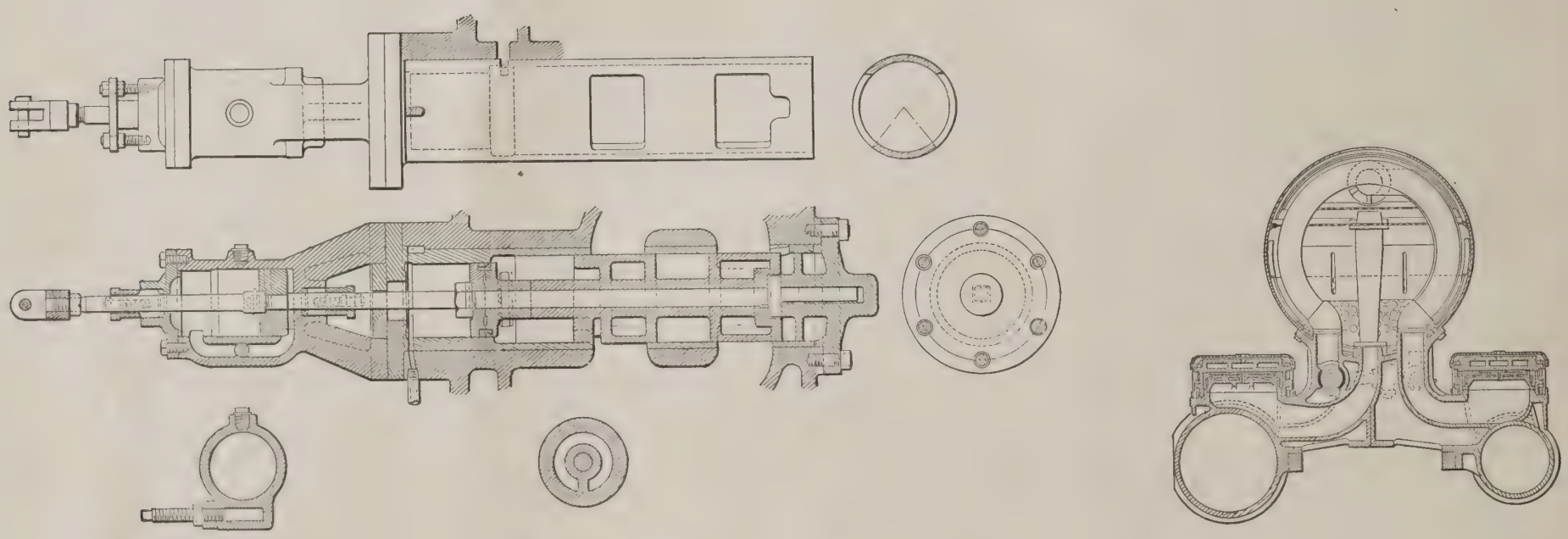

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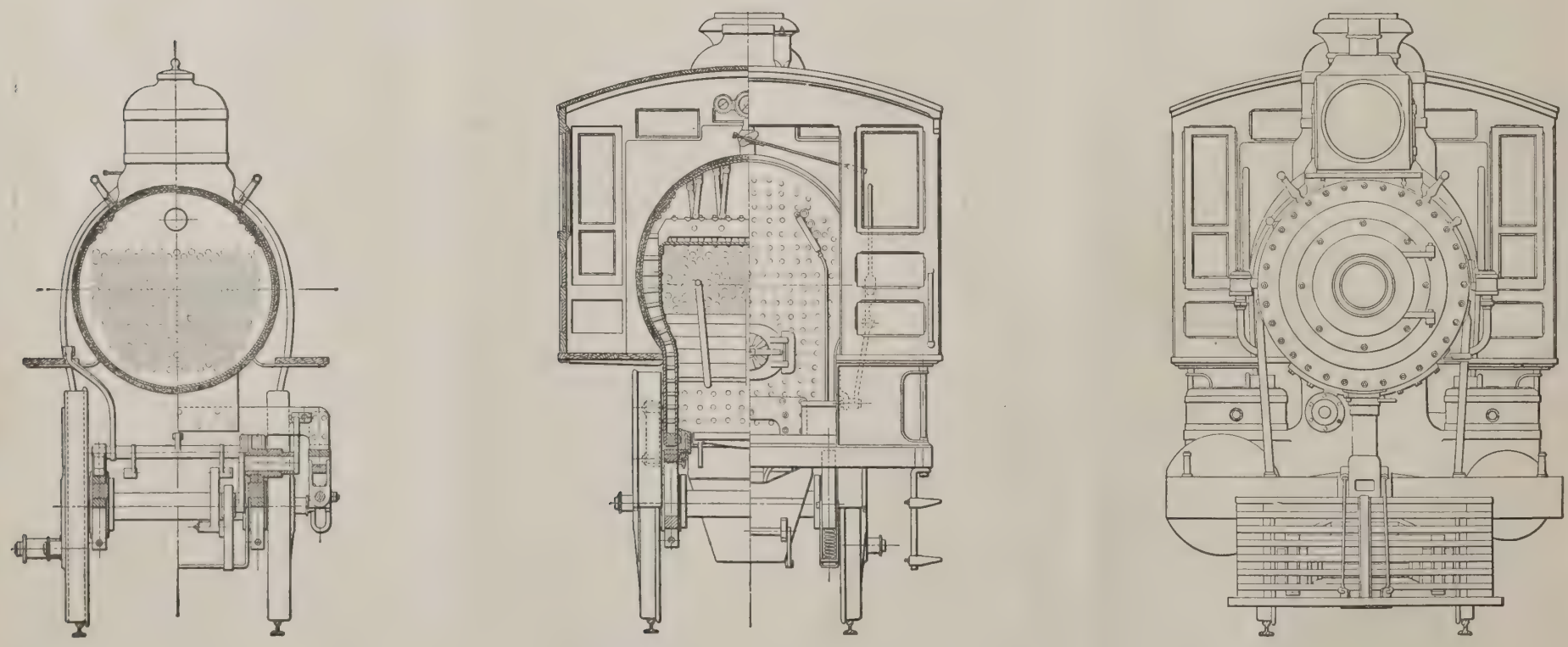

SCHENECTADY COMPOUND LOCOMOTIVE.

Schenectady Compound Locomotive.

The locomotive illustrated in the annexed engravings and in a full page supplement, was designed by the Schenectady Locomotive Works for heavy express service on the Michigan Central Railroad. Aside from being compound (instead of simple), it is a duplicate of a class of 19 × 24 inch ten-wheelers recently furnished this road, which is their standard type of engine for heavy passenger service. Ample weight on drivers and proportionate cylinders and boiler capacity, in connection with the wide, shallow fire-box, has, after careful and prolonged experiments, demonstrated conclusively that this type is eminently qualified for the service above mentioned, being more economical in fuel, and guaranteeing the running of the heavy fast trains on time with speed and safety.

This particular engine shown in the illustration is a two-cylinder compound engine, and as a new departure in locomotive building in this country, will be looked upon with a large degree of interest by all railroad and scientific men, and its performance in actual service will be awaited with eagerness. A careful examination of the illustrations will show that the standard types of American locomotives can be compounded without the undue multiplication of complicated parts, and new methods of operation resulting therefrom be acquired by those having the engine in charge. The designers of this engine, firmly believing that these are important factors, have given equally as much attention to these points, as to the specific principles of compounding, and the result is the evolution from a simple ten-wheel engine to a compound ten-wheel engine of equal capacity, with the minimum additional parts, whose automatic operation is of great simplicity, and an engine in which the engineer has no new methods to acquire in running. Undoubtedly, there exists in the minds of many of our railroad men the idea that the compounding of our locomotives will result in complicated mechanism, a large additional first cost, and the increased expense made necessary for the maintenance of the same. As the object of compounding locomotives is purely economy in fuel, the question might naturally be raised, will the economy of fuel obtained sufficiently compensate the purchaser of an engine for its additional cost and expense of maintenance? Yet, however, if a compound locomotive is produced in which the additional first cost is but a nominal sum, and with a cost of maintenance so small that it is hardly needful to take it into consideration, it follows, then, that whatever economy in fuel is obtained is clear gain and will proportionally reduce the operating expenses of the road.

A brief description of the principles embraced in this engine is as follows: The high-pressure cylinder, which is 20 inches diameter, is located on the left side of the engine; the low-pressure cylinder, 29 inches diameter, being upon the right side, the right hand crank leading. The cylinders are cast with half saddles attached, and are bolted together, and to the frames and smoke box, in the usual manner; the arrangement of the guides, crossheads and running gear, as well as the valve motion throughout, does not vary from the ordinary forms of construction. In the right cylinder saddle is placed a multiple piston valve, called an intercepting valve, which, as its name implies, is used to control and govern the ingress of live or exhaust steam, as the case may be, to the low-pressure cylinder. The exhaust steam is conveyed from the high to the low pressure cylinder through an arched pipe of horseshoe shape, passing from one saddle to the other around the inside of the smoke box. This pipe with the passages in the two saddles and the low pressure steam chest form the receiver. Great care hes been taken to make all of the steam passages of ample area, and of such form as to avoid the reduction of pressure of the steam passing within them, and, in every case possible, the steam and exhaust passages have been separated by spaces between, to prevent loss of pressure due to radiation or condensation. As will be clearly seen later, the engine is designed to exert its full power at the moment of starting, and is capable of starting with the cranks upon either side of the engine upon the center. In fact, the engine cannot stop in any position whatever from which it will not start by merely opening the throttle. Referring to Fig. 2 of the illustration of the intercepting valve, it will be seen that it consists of three pistons working conjointly endwise in a brass bush or cylinder, which is pressed into the cylinder saddle. In this bush, as well as in the saddle, are two openings, top and bottom, through which the exhaust steam must pass as it traverses from the high to the low pressure cylinder. Near the back end of the bush, and on the inside, is a port which is connected through suitable passages and pipes with the live steam passage in the high pressure cylinder. In this pipe, and at the rear of the cylinder saddles, is introduced a pressure-regulating device, the office of which being to supply live steam to the low pressure cylinder at a reduced pressure, which bears the same ratio to the boiler pressure as the ratio of the two cylinders respectively. It will be noticed that the rear piston of the intercepting valve is of a smaller diameter than the remaining ones, and that live steam is admitted to the interior of the brass bush between the two pistons of different areas, the preponderance of pressure being such that the valve will move forward. On the back of the saddle is bolted an oil cylinder or dash pot in which is a piston secured to a rod which is common to this piston and the pistons of the intercepting valve. This rod is carried backward, and connected to a lever fastened by a pivot to the side of the boiler, a rod running from the top of the lever to the cab serving as an index to the engineer of the position and working of the given parts. The rapidity of the movement, to and fro, of the intercepting valve is governed by a regulating device, consisting of a screw plug on the bottom and at the side of the oil cylinder, by which the opening in the port through which the oil flows, as it passes from one end to the other, may be enlarged or diminished at will. To increase the speed of opening and closing of the valve, the oil cylinder is counterbored in the center for a portion of the stroke, allowing the rapid passage of the oil by the piston during this portion, but nearing the end of the stroke the piston is cushioned and the rapidity is reduced in proportion to the amount of opening given to the oil by the regulating device.

The method of operation of the intercepting valve, which is entirely automatic throughout, is this: when the throttle is opened, live steam is admitted to the high-pressure cylinder, while at the same instant live steam passes through the reducing valve and port to the brass bush in the interior of the intercepting valve, and as heretofore explained, forces the valve forward to the end of the stroke, thereby uncovering a live steam port in the lower side of the central piston of the intercepting valve through which the live steam passes on to the low-pressure steam chest, and thence into the cylinder. As the valve is forced forward it will be seen that all communication is shut off between the high and low pressure cylinders, thereby preventing the live steam from entering the high-pressure cylinder as back pressure. As the engine is now in operation, the exhaust from the high-pressure cylinder into the receiver accumulates above the intercepting valve, and through an opening in the upper side of the brass bush at the front, and exerts its pressure upon the front side of the forward piston of the valve, and overcoming the existing pressure of the live steam at the opposite end by means of the larger area, forces the valve back to the end of its backward stroke, cutting off the supply of the live steam, and forming a direct and free opening between the high and low pressure cylinders, and the engine continues to run compound until the throttle is closed. The cylinders for this engine are designed in the ratio of 2.1 to 1, the aim in the proportion of parts being to divide the work as nearly equal as possible on both sides of the engines. The details of construction, and the simplicity and neatness of design, are clearly shown in the accompanying illustrations.

This engine was delivered to the Michigan Central Railroad Company toward the end of December, and was at once put to work hauling the freight trains handled by ordinary locomotives of similar capacity. She did the work with regularity and dispatch and with a decided economy of fuel, although the exact extent of saving cannot yet be determined. After running freight for several weeks the engine was put into the heavy fast passenger service, operated so successfully with the ten-wheel engines previously built for the company. The train she was first tried on generally consists of nine cars weighing about 350 tons, and ran from Detroit to Michigan City, 228 miles, in six hours and 37 minutes, making eleven stops on the way. This is 34½ miles an hour, exclusive of stops, and they raise the running speed above 40 miles an hour. The engine proved equal to handling these trains successfully, but at first it was found that she did not run freely at the higher speeds. The valves were then removed and ⅛ inch inside lap cut out of the low-pressure side and the high-pressure valve given $\frac{3}{16}$ inch clearance. This change made a remarkable difference in the speed capabilities of the engine, and she now runs as freely as the ordinary passenger engines at the highest velocity called for. From the start the engine has displayed astonishing quickness in starting with a train, and on this account has become highly popular with the trainmen. The writer has had long experience in handling locomotives noted for their "smartness" in starting trains, but he never was on an engine that approached the compound in this respect. After the changes referred to were made on the valves we went out with the engine on a mail train consisting of five cars. Indicator diagrams were taken from both cylinders at frequent intervals during the trip and a record was made of the speed attained. Within three-quarters of a mile after leaving a station the engine attained a speed of 234 revolutions per minute, or 47 miles an hour. Among the performances of this trip was running 37 miles in 54 minutes and making six stops. The speed between stations always reached or exceeded 60 miles an hour, which called for 296 revolutions per minute and 1,184 feet of piston speed in the same time.

The engine can be handled as easily as a common engine, and the action of the intercepting valve is entirely automatic, so that a man handles the machine just as he does an ordinary locomotive. It was expected that he would have to open the intercepting valve before starting to admit steam direct into the low-pressure cylinder, but in practice it is found that the suction of the piston when steam is shut off draws open the valve and puts it in the right position for starting. On starting, one exhaust from the high-pressure cylinder fills the receiver pipes, and the intercepting valve immediately closes.

As the passenger trains on the Michigan Central are heated with steam taken from the locomotive boiler, it is difficult making an exact estimate of the fuel saving effected by the compound. Systematic tests will be made soon, which will settle the question beyond a doubt.

The following are the general dimensions of the engine:

Fuel	Bituminous coal.
Gauge of road	4 ft. 8½ in.
Total weight of locomotive in working order	126,800 lbs.
Total weight of driving wheels	97,000 lbs.
Total wheel base	22 ft. 6 in.
Driving wheel base	12 ft. 2 in.
Rigid wheel base	6 ft. 3 in.
Length main connecting rod (centers)	9 ft. 5 in.
Transverse distance between center of cylinders	7 ft.

CYLINDERS AND VALVES.

Diam. of h. p. cylinder	20 in.
" l. p. "	29 in.
Stroke of both pistons	24 in.
Ratio of l. p. cly. to h. p. cyl. areas	2. 1 to 1
Kind of piston packing	Cast-iron steam.
" " rod packing	U. S. metallic.
Diameter h. p. piston rod	3¼ in.
" l. p. " "	3½ in.
Size of steam ports h. p.	18 in. × 1⅛ in
" " " l. p.	20 in. × 2⅛ in.
" exhaust ports h. p.	18 in. × 3 in.
" " " l. p	20 in. × 3 in.
Greatest travel slide valves	6½ in.
Lap of slide valves h. p.	Outside, 1⅛ in. / Inside clearance, 3-16 in.
" " " l. p.	Outside, 1⅛ in. / Inside clearance, 1-16 in.
Lead of " " full stroke	3-32 in.
Kind " "	Allen-Richardson, balanced
Width of Allen port in slide valve	¾ in.
Kind of valve stem packing	U. S. metallic.

WHEELS, ETC.

Diameter of driving wheels, outside tires	68 in.
Kind of tire	Krupp crucible steel.
Diameter and length driving axle journals	7½ × 8½ in.
" truck wheels	30 in.
Kind of truck wheels	Krupp steel tired.
Diameter and length truck axle journals	5 in. × 9 in.
" " main crank pin journals	5½ in × 5½ in.
" " intermediate pin journals	5½ in. × 4½ in.
Diameter and length F. & B crank pin journals	4½ × 3⅞ in.
Length driving spring (centers)	Main, 44 in.; front, 34 in.

BOILER.

Working pressure	180 lbs.
Style of boiler	Wagon top.
Diameter first ring outside	58 in.
Material and thickness of plates in boiler	Steel, 9-16 and ½ in.
Horizontal seams	Quadruple riveted with welt strip inside.
Circumferential seams	Double riveted.
Size firebox inside	Length, 96 3-16 in.; width, 42⅞ in.
" " " depth	Front, 59¼ in; breadth, 56¼ in.
Material and thickness plates inside firebox:	Steel; crown, ⅜ in.; tube, ½ in.; sides and back, 5-16 in.
Water space around firebox	Front, 4 in.; sides and back, 3 in.
Crown stayed by crown bars.	
Size of crown bars	.5 × ¾ in.; welded at ends.
Material of tubes	Semi-steel.
Number of tubes	247
Outside diameter of tubes	2 in.
Length of tubes over tube sheet	12 ft.
Heating surface in tubes	1,540.3 sq. ft.
" " firebox	137.1 "
Total heating surface	1,677.4 "
Grate surface	28.5 "
Ratio total heating surface to grate area	58.8 to 1
Ratio fire box " " " "	4.8 to 1
Ratio flue " " " "	54. to 1
Area flue opening	4.1 sq. ft.
Fire brick in fire box supported on water tubes.	
Style of grate rocking bars	With drop plate.
Style of ash pan: Hopper with drop plates operated from the cab.	
Throttle balanced valve in dome.	
Inside diameter of stack	18 in.
Smoke stack top above rail	14 ft. 9¾ in.
Boiler supplied by two monitor injectors placed right and left.	

TENDER.

Weight of tender, empty	36,280 lbs.
Number of wheels	8
Diameter of wheels	33 in.
Diameter and length of truck axle journals	4¼ in. × 7½ in.
Total wheel base tender	15 ft. 6½ in.
Distance from center to center truck wheels	4 ft. 4 in.
Style of tender frame	Angle iron.
Style of trucks: Schenectady Locomotive Works, patent, 4-wheeled, channel iron bolster.	
Center bearing F and B, with additional side bearings over back truck.	
Water capacity in tank	3,800 gal.
Coal capacity	8 tons.

ENGINE AND TENDER.

Total wheel base engine and tender	48 ft.
Total length of engine and tender over all	58 ft. 11¾ in.

The New York, Providence & Boston have placed an order with Rhode Island for two boilers, and is about to place an order for a duplicate of the J. W. Miller, an engine about which so much has been said and written pro and con. Mr. Butler certainly deserves great credit for his success in so modifying this engine that she is now meeting all their expectations, and warrants the placing of second orders. This is a marked indication of what mechanical ability and dogged perseverance will do.

The New York, New Haven & Hartford Railroad Company have fought to the bitter end the law prohibiting the use of stoves in railroad cars, but the fight has gone against them. The company claimed that the law of New York State prohibiting the use of stoves in passenger cars did not apply to their road because only twenty-six miles of their track was within the State of New York, and railroads under fifty miles long were exempt by the law. The exemption feature of the law was evidently intended to apply to small roads running mixed trains, and the Railroad Commissioners of New York held to this view, and brought suit against the New York, New Haven & Hartford for penalties amounting to $7,000, and the company demurred. Upon demurrer Judge Ingraham, in the Supreme Court, Special Term, gave judgment for the State, holding the law applicable to all trunk lines passing into the State. The company appealed and the judgment has been sustained by the General Term. This decision will be of great importance to the railroad companies in New York State, and it will also indicate that laws passed by other States prohibiting the use of stoves are not to be ignored with impunity.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Sixth Paper.

ECONOMY OF TWO-CYLINDER COMPOUND LOCOMOTIVES.

The various reasons why compound locomotives should be more economical than those of the common type have been so often stated at length before the railway clubs in this country, before engineering societies abroad, and by the advocates of the different systems of compound locomotive construction, and the whole theory of compound or multiple-cylinder engines has been so thoroughly developed, especially in the numerous books on the steam engine, that an extended discussion of the question in this paper seems to be uncalled for. Nor does the compound locomotive need the support of arguments to show why it should be more economical than locomotives of the ordinary type, inasmuch as the economy of the compound has been repeatedly demonstrated by that best of all arguments, actual tests in service.

Admitting then, that a noticeable saving in fuel follows the use of compound locomotives, there remains to be shown the actual amount of this saving, under what circumstances it will pay to build compound locomotives, and the conditions which will make it advisable to alter existing simple locomotives.

The accompanying table contains a list of comparative tests of compound and simple locomotives which would seem to be sufficiently comprehensive in number, duration, boiler pressures, location and kind of service to convince the most skeptical that there is considerable saving in the use of the compound system. The data for this table have been collected from various sources which are presumably reliable. A considerable number of tests are quoted from Mr. Lapage, and for the more recent results in Saxony, I am indebted to Mr. D. L. Barnes. The table shows that the saving in fuel is from 13 to 24 per cent., and it will be noticed that the highest percentage of saving is for a six months' trial (No. 14) of two engines working with the same boiler pressure and of almost identical dimensions. Other cases in which the same boiler pressure was used are Nos. 2, 4, 6, 7, 16 and 19. In No. 7 the boiler pressure was but 120 pounds, which is generally admitted to be too low for the best results ot compound working. The saving in this case was 13.5 per cent., and the next lowest, with equal boiler pressure, is (No. 6) 16 per cent.

It has been claimed by several engineers, whose reputations give weight to their opinions, that a large part of the economy of compound locomotives is due to the higher boiler pressures employed, and that equally good results can be obtained with simple engines. On the other hand, engineers of equal prominence have failed to find any material advantage in the use of what may to-day be called high pressures in ordinary locomotives. There is undoubtedly from theoretical considerations a marked economy in the use of high pressures, provided that full advantage is taken of the greater range of expansion which the higher pressure makes possible. It is not practicable to obtain economical results if a large ratio of expansion is used in one cylinder, on account of the greater condensation, to say nothing of the great variation in the pressure on the crank pin during a stroke. We thus find two conditions which are conflicting as the pressure is increased, and in the locomotive we have the further obstacle that with the ordinary forms of valve gear it is not practicable to cut off steam very early in the stroke. There is no advantage in using higher pressures and correspondingly smaller cylinders, so that the points of cut-off will remain about the same as with the lower pressure, because while the volume used per stroke to obtain the same total pressure on the piston is less, the weight of each cubic foot of steam has increased with the pressure, and the amount of heat drawn from the boiler per stroke will be very nearly the same.

In the compound or multiple-cylinder engine advantage may be taken of the possibilities of high-pressure steam without encountering the losses which follow from extremely early cut-offs in a single cylinder. This is another point of superiority of the compound engine, and while some saving may be accomplished in the simple locomotive with higher pressure by means of somewhat smaller cylinders and a slightly earlier cut-off where practicable, it does not appear that a saving of fuel equal to that of compound engines can be reasonably expected.

The general average of the results in the table, computed by giving each test a value proportionate to the time covered by it, is 18.5 per cent. Making allowance for the probability of special care having been exercised in some of these tests in favor of the compound, it would seem to be safe to estimate upon the basis of 15 per cent. saving. The annual saving per engine on any road on the basis of an assumed percentage, such as 15 per cent., is of course easily calculable from the record of engine mileage and fuel consumption. If the ordinary engine for which it is desired to substitute a compound makes M miles per annum and T miles per ton of coal, which costs D dollars per ton, the annnal saving by the compound would be in dollars $\frac{.15 \times M \times D.}{T}$ For example, with coal at $2 per ton, 30 miles per ton, and 20,000 miles per annum, the annual saving per engine would be $\frac{20{,}000 \times 2 \times .15}{30}$ = $200. It is obvious that the advisability of using the compound system varies directly with the *total* cost of fuel per engine per annum, and not necessarily upon the cost of fuel per ton. For instance, with 25 miles per ton, 25,000 miles per annum, and coal at $1.33 per ton, the annual saving per engine will be the same as that given above.

Mr. von Borries gives the cost of his compound locomotives in one case as from 2 to 3 per cent., and in another case 4 per cent., more than ordinary locomotives of equal weight. He also states that "The power of compound freight locomotives is known by experiment to be 5 to 10 per cent. and of compound passenger and express locomotives 10 to 15 per cent. higher than that of ordinary locomotives of equal weight, so far as not hindered by the adhesion of drivers to rails. For an equal power the compound passenger locomotive is lighter and cheaper than the ordinary locomotive." Accordingly, for equal powers, the first cost is "in freight engines two to five per cent., and in passenger engines eight to twelve per cent. *lower* than ordinary locomotives, similar construction of course being assumed in both cases." Mr. Lapage makes there is a possible reduction in these which is worthy of consideration. To offset this we will have the increased weight of cylinders, pipes, etc., in the smoke-box, and ordinarily some increase in the thickness of boiler plates following the increased pressures. In view of the lack of experimental data of compound locomotives in this country at the present time, it would seem to be advisable to disregard these possible reductions in first cost.

The figures given by Mr. von Borries, from two to four per cent. more than the cost of ordinary locomotives of equal weight, or, on the above basis for the same work, are presumably based upon the cost of a number of engines, and would not therefore be sufficient for a single engine if the cost of drawings and other expenses incident to getting out a new design are to be charged to it. But even if all expenses which are properly chargeable to the engine are included, it is apparent that the probable saving of 15 per cent. will secure a good return from the investment. It is claimed by the advocates of some of the various systems of compound locomotives that the cost of their maintenance is no greater than that of the ordinary engines This claim appears to be reasonable, as the slight increase in the cost of repairs which would naturally follow the introduction of additional parts may be balanced by the increased endurance of the boiler, taken all together, on account of the diminished intensity and frequency of the exhaust.

The cost of converting simple locomotives to compound will depend largely upon the type which the working conditions make it advisable to adopt. The simplest case will be that in which one cylinder of the ordinary engine can be retained for the high-pressure cylinder of the compound, and a simple form of starting gear such as Lindner's is adopted. The minimum changes required will then be a new cylinder and piston for the low-pressure, new pipes for the receiver, etc., a starting valve and connections, a safety valve on the receiver, and probably two new slide valves and slight changes in the valve motions. The other extreme is apparently that in which two new cylinders are necessary, and starting and intercepting valves of the Mallet type are adopted. In any case the probable cost can be closely estimated from a detailed cost sheet of ordinary engines of similar dimensions in the shops in which the alteration is to be made. Mr. Hughes gave the cost of converting a 16 × 24 engine in India, which has been already referred to, as about two hundred dollars, which is probably considerably lower than the same work could be done for in this country. Judging from such cost sheets as are at hand, it seems probable that the minimum cost would not be less than three hundred dollars, and may be as high as seven hundred dollars for the more complicated arrangements. But, even with the latter amount as a basis, it is evident that there are many cases in which the expenditure would be advisable.

EXHAUST NOZZLES.—There is a very noticeable difference between the exhaust from compound and simple locomotives. As the average expansion in the compound is considerably greater than in the simple engine, the final pressure in the low-pressure cylinder is comparatively low and the intensity of the blast is therefore much reduced. Also,

COMPARATIVE FUEL CONSUMPTION OF TWO-CYLINDER COMPOUND AND ORDINARY LOCOMOTIVES.

No.	Where Tests were made.	Date.	Duration.	Number of Engines tested.	Distance run. Miles.	Cylinders. Diameter, Inches.	Cylinders. Stroke, Inches.	Boiler Pressure, Pounds.	Driving Wheels. Number coupled.	Driving Wheels. Diameter, Inches.	Grate Area, Square feet.	Total Heating Surface, Square feet.	Weight in Working Order, Tons (2,000 pounds).	Coal used per Train mile. Pounds.	Saving by Compound. Per cent.	Remarks.
1.	Prussia.....	1883	2 months	1	.....	18.11 25.6	24.8	176	6	52.36	16.47	1308.9	43.1	49.32*	..	Freight.
				1	.....	17.01	24	132	6	54.02	18.30	1259.4	40.8	59.96*	18	"
2.	"	1883	2 months	1	.....	18.11 25.6	24.8	176	6	52.36	16.47	1308.9	43.1	73.80*	....	Two special trains on mountain sections only. Max. grade, 1 in 64.
				2	.....	19.02	24	176	6	51.10	21.53	1345.5	47.4	92.25*	20	
3.	"	1883-4	9 months	2	.....	18.11 25.6	24.8	176	6	52.36	16.47	1308.9	43.1	.....	....	Saving calculated from average actual consumption and ordinary consumption.
				10	.....	17.72	24.8	146	6	52.36	16.47	1340.2	42.4	.....	21	
4.	"	1883-4	9 months	1	.....	7.87 11.81	15.75	176	0	44.49	5.81	247.6	19 8	.....	...	Local passenger. Saving as in No. 3.
				1	.....	7.87	15.75	176	0	44.49	5.81	247.6	19.8	.....	17	
5.	"	1884	2 months	1	.....	18.11 25 6	24.8	176	6	52.36	16.47	1308.9	43.1	57.98*	....	Freight.
				4	.....	17.72	24.8	146	6	52.36	16.47	1340.2	42.4	67.66*	13.3	"
6.	" .	1884	2 months	1	.....	18.11 25.6	24.8	176	6	52.36	16 47	1308.9	43.1	46.48*	....	Special.
				1	.....	17.72	24.8	176	6	52.36	16.47	1340.2	42.7	55.35*	16	"
7.	India	1884	.....	1	6,555	18 24	22	120	4	60	.....	.....	.....	33.10	....	Both types of engines doing the same class of work.
				....	.....	15	22	120	4	60	.....	.....	.....	38.28	13.5	
8.	Prussia	1884-5	2 months	1	.....	16.54 23 62	22.84	176	4	73.23	18.84	1054.9	41.9	127.73*	....	Special, passenger.
				1	.....	16.54	22.05	146	4	73.23	19.38	1038.7	38.5	152.56*	16	" "
9.	" .	1884-5	2 months	1	.....	16.54 23 62	22.84	176	4	73.23	18.84	1054.9	41.9	145.47*	....	Passenger.
				2	.....	16.54	20.08	146	4	77.95	16.68	1334.8	47.9	170.30*	14.5	"
10.	"	1885	4 months	1	.....	18.11 25.6	24.8	176	6	52.36	16.47	1308 9	43.1	64.58*	....	Freight.
				1	.....	17.72	24.8	146	6	52.36	16.47	1340.2	42.4	76.64*	16	"
11.	England....	1886	3 months	11	109.470	18 26	24	160	4	84	.....	.....	49.8	29.4	....	Passenger.
				7	64,671	.....	.....	.....	.....	.....	.....	.....	....	33.8	13	"
12.	"	1886-7	.....	10	185,091	18 26	24	160	6	61.4	.....	.....	45.2	34.9	....	Freight.
				10	186,890	.....	.....	.....	.....	.....	.....	.....	.....	40.9	14.7	"
13.	Prussia.....	1887	6 months	4	43,372	18.11 25.6	24.8	176	...	52.3	16.68	1291.7	42.9	40.08	....	Coal trains—load drawn by compound 8 per cent. heavier.
				4	41,831	17.72	24.8	146	....	52.3	16.68	1345.5	42.9	47.55	16	
14.	Saxony.....	1887	6 months	1	6,773	18.12 25.6	24	176.4	6	55.6	15.17	1238.1	45.1	43.1	....	Freight.
				1	4,426	16.75	24	176.4	6	55.6	15.17	1238.1	44.4	56.7	24	"
				4	9,191	18	24	125	6	55 6	15.17	1237.8	42.9	55.7	22.6	"
				2	7,308	18	24	132.3	6	55.6	15.17	1235.7	43.5	55.7	22.6	"
15.	"	1887	4 months	11	.....	17.25 24.75	21.6	180	4	73.75	.....	.....	47.4	.....	.....	.....
				.....	.....	.....	.....	135	.....	.....	.....	.....	.....	.....	18	.....
16.	Argentine Republic	1887	1 month	1	3,638	16 23.25	24	160	4	67.5	.....	.....	40	22.36	....	Passenger.
				1	3,937	.....	.....	160	.....	.....	.....	.....	.....	28.19	20.7	"
17.	England.....	1888	2 months	....	893	18 26	24	175	4	80.75	.....	.....	91 1†	28.3	....	Passenger.
				....	893	.....	.....	.....	.....	.....	.....	.....	80.3†	35.9	21	"
18	Saxony.....	1887-8	18 months	1	46,206	16.55 23.6	22.1	176.4	4	75	19.58	1098.9	47.4	25.2	....	Express.
				1	45,285	16.55	22.1	154.4	4	75	19.58	1098.9	46.1	31.9	21	"
19.	"	1887-8	18 months	10	14,589	18.12 25.6	24	176.4	6	55 6	15.17	1238.1	45.8	43.4	....	Freight.
				1	21,207	16.75	24	176.4	6	55.6	15.17	1238.1	44.4	52.9	18	"
				4	26,459	18	24	125	6	55.6	15.17	1237.8	42.9	52.2	17	"
				2	19,008	18	24	132.3	6	55.6	15.17	1235.7	43.5	53.2	18.4	"

* Per 100 axle miles. † Engine and tender.

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instead of four exhausts in rapid succession during a revolution there are but two, and the total volume of steam exhausted in a revolution is somewhat greater. The result is a more even and less intense urging of the fire, from which more perfect combustion and transfer of heat to the boiler are to be expected, while the quantity of small coal drawn through the tubes will be proportionally less.

The single circular nozzle appears to be the favorite with the designers of compound locomotives abroad, the diameter of the nozzle being in the two-cylinder compound engines concerning which the writer has information, about one-fifth of the diameter of the low-pressure cylinder. The best proportion will naturally have to be determined by experience for different kinds of coal and for the various kinds of service.

SEQUENCE OF CRANKS.—The natural sequence of the cranks in two-cylinder compound locomotives would seem to be to place the low-pressure crank 90 degrees behind the high-pressure crank for forward running. Mr. Urquhart is reported as having tried the effect of placing the low-pressure crank leading in forward motion. The following is quoted from a paper recently read by him in England, as given by the *Master Mechanic:* "From indicator diagrams taken in forward gear with the latter arrangement, it appears that inconvenient and very excessive compression takes place at the first notch in the high-pressure cylinder, so much, indeed, that this notch is not used; but in all other notches a good distribution takes place. In the low-pressure cylinder a much better distribution takes place at all notches compared with engines having the high-pressure crank leading; and this engine with the low-pressure crank leading, which has only recently been put to work, seems to develop more power and to burn less fuel than the others having the high-pressure crank leading. . . . The receiver capacity is equal to that of the high-pressure cylinder, and all the dimensions are the same in both the above cases. The idea of making one engine, by way of trial, with the low-pressure crank leading in forward running originated in its being accidentally noticed that one of the other engines, compounded with the high-pressure crank leading in forward running, seemed to work better and to be more powerful, developing its full tractive force with an earlier cut-off and making steam with greater freedom, when running backward with its train, in which case, of course, the low-pressure crank became the leading one. . . . The only objection the author now sees to the low pressure crank leading is that it gives too much power in the large cylinder and too little in the small, thus putting the engine out of equilibrium; but this irregularity will in a great measure be obviated by having a receiver about half as large again as those now used on all the present compounds."

The writer has not as yet been able to discover any reason why, with a valve gear which gives an approximately equal distribution for both ends of the cylinders and with the usual long connecting rods, there should be any practical difference in the steam distribution with the two arrangements of cranks mentioned. Neglecting for the moment the irregularity caused by the connecting rods, for any position of the high-pressure crank, the low-pressure is at the same relative point in its revolution whether it is leading or following. For example, if the high-pressure crank is at a dead point, the low-pressure crank will be at either the upper or the lower half center, and the piston and valve will be in the same relative positions, the only difference being that the piston is making the forward stroke in one case and the backward stroke in the other. The same is evidently true for all positions of the high-pressure crank. The relative direction of the stroke will be changed, but the high-pressure piston will be at the same distance from the beginning of a stroke, whether its crank is leading or following. The irregularity in steam distribution caused by the connecting rods must be slight with the long rods which are commonly used in locomotive practice.

It would seem that there must be some other explanation of the difference found by Mr. Urquhart than the sequence of the cranks, and that the real cause has escaped his notice during the short time which this engine, with the low-pressure crank leading, has been in operation.

The Burlington road and other lines in the Western combine have adopted a scheme for identification of travelers on mileage books. On the back of the mileage book is a list of descriptive adjectives something like this: Slim, stout, medium, young, middle-aged, light hair, elderly, dark hair. When the purchaser of mileage receives his book the agent at the point of delivery punches holes in the back opposite the words which properly describe the personal appearance of the recipient, and a clue to identification is thereby furnished the conductor handling the mileage book. Thus. if the traveler on mileage is inclined to break faith with the railroad company and transfer his book, he must make the transfer to some one resembling himself. We should like to compare a few of the punchings with the individuals they pretend to identify.

The Cincinnati, New Orleans & Texas Pacific Railway have placed an order for 11 engines of various classes with Baldwin.

Michigan Central Shops at Jackson, Mich.

About twenty years ago the Michigan Central Railroad Company, perceiving the need for good, convenient shops for carrying on the repairs of their motive power, purchased a large tract of ground in a healthy location near the small country town of Jackson, Mich., 76 miles west of Detroit. Here substantial shops were built on what was regarded as the most convenient plan known, and they were equipped with the best tools and facilities for doing work that could be purchased. The company had in service at that time about 200 locomotives. The shops were built with plenty of clear space round them, and on a plan that admitted of easy and convenient extension. To-day they have on the United States portion of the road 300 engines, and each engine is doing double the work that each engine did twenty years ago, yet the repairs are all done in the shops at Jackson, and the shops are as convenient and as suitable for the work as many shops are that have been built within a year. This is the advantage of making a good original design. The design in this case was a common one of a large one-story oblong building for machine shops where there is room on one side for the machine tools and on the other side the repair pits. Parallel with this building are smaller structures for boiler shops, blacksmith shops, etc. The principal extension of buildings made since the shops were put up was a new brass and copper shop, which is now ready to be occupied. Formerly the brass molding and the copper and sheet iron work were done in part of the boiler shop, but the demand for more room has led to the devoting of the whole building to boilers. For this work they have already got an unusually good equipment of labor-saving tools, but they intend still further increasing the facilities. They are arranging to erect an overhead traveling crane to traverse the whole of the enlarged shop, and they expect to put in power riveting machinery in the near future. A new brick building has been erected for a pattern storage house. The building is as nearly fire proof as such a place can be made, and the windows are protected by iron outside shutters. The patterns are arranged on shelves, the contents being lettered and numbered to agree with the index book kept in the house.

The changes rendered necessary to make old locomotives suitable for the hard work of modern service calls for a great deal of boiler work. The boilers of nearly all engines over five years old are too small, and a railroad company that is able to enlarge the boilers soon saves sufficient coal by the change to pay for the work done. The Michigan Central has adopted the policy of increasing the boilers of all good engines that are over-cylindered, and in little more than a year they have built thirteen new boilers to be used in this line of improvement. Last year they gave new boilers to ten engines, and rebuilt the other parts, making practically new engines. Most of the engines changed had originally boilers with 46-inch shell, firebox 60 inches long, and the driving wheels set seven feet apart, and 51-inch wheel centers. The rebuilt engines have boilers 48 inches diameter, and fireboxes 66 inches long. The frames were lengthened out to admit of this longer firebox, and the wheels were set eight feet apart, the centers of the latter being made 57 inches diameter. New substantial deck plates were put on the engines, and all the attachments made strong and heavy. The increase of weight on the drivers is close on 4,000 pounds. The steam pressure carried on the old boilers was 130 pounds per square inch, while on the new boilers it is 145 pounds. Although the diameter of cylinders has not been changed, the power transmitted is found ample for the increased weight and increased diameter of wheel. The engines have extension smoke-box and open stack, and are equipped with Westinghouse air brake for drivers, tender and train. They are found to be very well adapted for running light passenger trains.

Among work recently turned out is an entirely new six-wheel switching engine with cylinders 18 × 24 inches and driving wheels 51 inches. The boiler is 54 inches diameter, with double-riveted, longitudinal seams and inside welt. They do not calculate to perform more new work than what will equalize the running of machinery; yet few repair shops are better provided with good machine tools. Mr. C. E. Smart, general master mechanic, has very sound views about tools, and the management sustain him in the policy that a railroad company cannot afford to pay the high expense of production with antiquated machinery. In the course of a walk through the machine shop I noticed a fine, new Bement boring mill, recently put to work. The man in charge said that he could now bore out and face the heads of cylinder in 7 hours, while it took 22 hours to do the same work on a large lathe, which was considered an excellent tool of its kind. I also noticed some new heavy milling machines and a turret lathe, besides several smaller tools.

There is noticeable here remarkably cordial relations existing between workmen, trainmen and the officers of the company. When mistakes are made, or when disagreements arise, the spirit of conciliation makes the working of discipline mild in the one case and leads to mutually satisfactory settlement in the other. An eloquent manifestation of the interest displayed by the officers of the company in the welfare of the employés, is the maintenance of an evening school for the instruction of apprentices and others in mechanical drawing and other technicalities connected with the business the scholars are engaged in. The company defray all expenses connected with the school, which consists of an elementary and advanced class and Mr. Ledyard, president of the company, is reported as taking a warm personal interest in the success of the school. The classes are held in the rooms connected with the master mechanic's office every evening, immediately after work stops. Those for whose benefit the classes have been formed display their appreciation of the benefits conferred by giving regular attendance and by working industriously to acquire skill in the arts taught. The progress made is in most cases satisfactory, and in some cases remarkable. All machinists cannot be made mechanical engineers or leaders in their business, but there is no want of room on the top of the business for those who make themselves fitted for positions above the lathe and the vise bench. The young machinists of this generation who spend their evenings accumulating the capital of skill and knowledge acquired at science classes will be the industrial leaders of the next generation. The Michigan Central Railroad Company, like all the other Vanderbilt roads, are doing their part toward encouraging the young men in their employ to rise in their several vocations. Mr. Smart appears to take as much interest in the night school as if every boy in attendance was his own son.

A. S.

New York to Washington in Four Hours.

The Baltimore & Ohio, the Philadelphia & Reading, and the Central of New Jersey railroad companies have combined to introduce a thoroughly first-class fast passenger train service between New York and Washington. The cars to form the trains will be owned conjointly by the three companies, the cost to be divided on a ratio mutually agreed upon. The cars will be of the finest and most luxurious that can be built, as no expense will be spared on anything that will tend to make them handsome and comfortable. The intention is to run the trains from Jersey City to Washington, with only one stop, at Philadelphia. Mr. Austin Corbin, of the Philadelphia & Reading, maintains that a running speed of 55 miles an hour will be kept up, and that the run from New York to Washington will be accomplished in four hours and ten minutes.

We are very glad to see the roads mentioned preparing to put into operation a really fast train service between the highly important cities of New York and Washington. Every person interested in first-class railroad travel will watch this experiment with lively interest. It is, however, an easier matter for the presidents of railroad lines to give orders that excessively fast trains be run than it is for the operative officers to send them along on the specified schedule. An average running speed of 55 miles an hour has never been done regularly on any American railway, and we are a little doubtful about the runs being made on the time specified by Mr. Corbin. It would be an easy matter to find a class of locomotives that would make the speed required with a light train if the velocity could be kept up throughout the whole run. But the country traversed between New York and Washington is thickly populated and the street crossings of the numerous towns passed through are nearly all on the level. To run over them at sixty miles an hour would in many cases be highly dangerous, and it is doubtful if the speed would be permitted. Should the authorities of the towns traversed throw no obstacle in the way of fast running through their streets, there are other difficulties to be overcome. To run trains at that phenomenal speed safely there ought to be proper provision made for keeping trains a certain distance apart. This can be done successfully only by the use of an absolute block system of signals. We are not informed that the companies combining to operate this fast train service have arranged to secure safety by the introduction of a perfect system of signaling; but it is certain that those responsible for the safety of the passengers carried will subject the trains to dangerous risks unless the most approved means for preventing collisions are put into operation.

If the fast trains should be run safely with punctuality the service is certain to prove popular, but if the trains are to be late all the time as the slower express trains now are on many roads, the promise of accelerated speed will merely be new cause for public complaint.

The superintendent of the Philadelphia division of the Pennsylvania Railroad, in a recent interview with a newspaper reporter, said that every day of the year some of the switchmen employed in the yards outside of Philadelphia get killed or injured. "The daily accidents to brakemen are of such frequent occurrence that the Pennsylvania Railroad Company have special reports made of them, and the superintendents of the various divisions render a faithful accounting of the casualties to brakemen within their precinct during every twenty-four hours. The blank is filed out with the name of the injured man, and the circumstances of the accident. These reports are filed among the company's archives."

The Rio Grande Western have used Utah fir and California redwood ties in all the extensions of track lately built, and to increase the durability of the tie they have adopted the Servis tie plate, which is said to be giving great satisfaction wherever used.

Americans Abroad.

At the January meeting of the New England Railroad Club, President Richards in the chair, the following notes of travel were presented:

Mr. Albert J. Pitkin, superintendent of the Schenectady Locomotive Works: My short stay abroad was filled with matters of interest, as you can well imagine, it being my first trip. As your president stated in our conversation at Niagara Falls, we are very bright in America, but we don't know it all. I was very agreeably surprised in the comfort of travel in Great Britain after the discomfort of an all day's journey on the Continent. The new coaches, at least the first class compartments, have such conveniences as will enable the traveler to reach his journey's end with a degree of comfort not attainable on the Continent. The roadbed is in excellent condition, the rails being much heavier in proportion to the weight of the rolling stock than in this country. Metallic ties, with cast-iron chairs for holding the rails, are used largely, and altogether, we have much to learn in this respect from our cousins in Great Britain. The passenger service has some marked superiority as a commercial enterprise in the fact that the dead load of car per passenger is about ¼ or ⅓, I should judge, of what we have here.

The compartments have certain advantages not attainable in our cars. The doors at the sides afford a means of ingress and egress that allows the passengers more freedom than we attain. I noticed that, as I stepped from the door to the platform and walked toward the forward end of the train, before I had reached half the distance the passengers leaving the cars were all out and the newcomers seated in their places. In a number of instances I timed the stops at the stations, and found that they were from thirty seconds to one minute, except, of course, at large cities. Thus, even their local trains make very good time over the road. I spoke of the gentlemanly porter. Every man in the railroad employ is gentlemanly, not only in Great Britain, but on the Continent. In the two weeks of almost uninterrupted travel by rail, we met with nothing but politeness and kind treatment from the red-capped government officials in charge of the stations in Germany to the guard who politely opens the door and calls out the name of the stations. In this respect "Free America" has much to learn.

The locomotives used abroad have been so fully illustrated that Americans generally have a very good idea of their design. The principal departure from the usual standards is the compounding, which seems to meet with considerable favor. Some of the proportions of these engines, however, would hardly meet with approval here; for instance, one of the new designs is a 20 and 28 × 24 compound, having a single pair of driving wheels 7½ feet in diameter, the weight on drivers being but 40,000 pounds. We would naturally think this engine over cylindered and would expect it to lose about as much in slipping as would be gained by the compounding. The engine with twelve of the light English cars did slip badly in starting and the speed decreased to a marked degree on ascending grades. Still, such economy is shown in the compounding of the various types that this particular road is building nothing but compounds for road traffic. Another road is building passenger engines, *only*, compound. With our modern designs of locomotives, having large boiler and consequently more weight on drivers for a given cylinder power, there seems no reason why the principle of compounding should not be successfully introduced. The criticism we so frequently hear, that the compounds are slow in starting trains, seemed to have foundation in the fact that they slipped badly from lack of sufficient adhesion, and consequently cannot exert their full cylinder power.

The workmanship on locomotives is laboriously perfect, much time being spent in finishing and polishing parts that for ordinary service were better painted. Many of the designs seem to have been made with little idea of cost of construction, and, as is well known, the working parts are very inconvenient to get at for any little repair necessary to be made on the road. This, however, is the exception rather than the rule, as the locomotives generally are well designed for the service, and perform the work with marked success.

In looking through the various shops one is impressed with the superiority of our modern design of machine tools. In very few instances do you find tools that compare at all favorably with those now made by our best builders. This is due largely, no doubt, to our depending so entirely on tools in reducing the cost of production rather than by decreasing the amount of wages paid the workmen.

Mr. John Coghlan, master car-builder, B., R. B. & L.: After landing we went to examine the first, second and third class cars. The two latter classes had just light enough admitted to make the darkness visible, and while the second-class cars were fairly well upholstered, the third-class cars had merely a piece of carpet tacked on the seats, which were the soft side of a pine board. We also examined the two grades of first-class cars. We found no closet accommodations. The Midland Railway has probably more improved systems of construction. They are adopting as nearly as possible the American systems, which indicates that whatever prejudices the nobility may have as to exclusiveness, the prevailing opinion is that our system should be generally adopted. We then took a Belfast and Liverpool steamship of about 500 tons, built on the same lines and by the same builder as the "Teutonic." The speed that night on a chop sea was 21½ knots an hour while I was on deck, an astonishing speed for a small vessel. Reaching Belfast, 125 miles distant, the next morning at 8 o'clock, having started at 11 o'clock, we went with a letter of introduction to Messrs. Carrollton & Wolfe, a large shipbuilding concern, where we were courteously allowed the privilege of examining the works. There were six sister ships to the "Teutonic" on the stocks in process of construction, one of them, which will be completed about June 1, having a capacity of 3,000 more horse power than the "Teutonic," and is expected to show a speed of 22½ knots an hour.

Returning to England, determined to get an experience of the different styles of railroad travel, we first traveled first-class on the Northwestern Railway, and found that one shilling would insure the utmost courtesy from the employés of the road, while when that could not be obtained they were as discourteous as possible, and I can say that for fair and square and courteous dealing by railroad employés the trainmen in the United States are unsurpassed.

On our train from Fleetwell to Preston there were twelve cars of the first, second and third class. At Preston there is about fifteen minutes' stop, and there they took on ten more coaches, The next stopping place was Crewe, where they took on ten more cars, making a train of thirty-two cars, which the engine seemed to draw without any great hardship. I did not see that the passengers got out of the coaches any more rapidly than they would from the cars of the Boston & Albany or Old Colony railroads.

Our box cars would ride a hundred per cent. better than the third-class French cars did, judging from our experience, and they were very poorly lighted. The first-class cars are somewhat better.

The President: We have with us to-night Mr. Firth, who has spent several years in Russia and Germany, and who kindly consents to give us the benefit of some of his thoughts.

Mr. Firth: I think nearly everthing has been said that I could say. I have just come from San Francisco to this city, and I am bound to repeat what I have heard here to-night, that you excel Europeans in comfort in railroad travel, even including Russia; but I would like to make an exception in favor of Russia, in that they are fortunate because, in the early days, they had American engineers to build their principal railroads, who installed a system which is practically American, and they still adhere more or less to your admirable construction of railroad carriages.

In Russia we have your American Baldwin locomotive and the Grant locomotives. We have stuck to the direct action between the eccentric and the valve with, so far as my experience has gone, great advantage in the mechanical working of the locomotive itself. Russia began to build for itself extensively about 10 or 12 years ago, and I think their engines have a larger heating surface than you gentlemen use. Russia to-day has good schools, and is educating its young men in all that belongs to technology, and among other subjects they have get hold of the construction of railroads and the construction of railroad rolling stock. In short, in my opinion, nowhere in Europe but in Russia, and in America, can be found the nearest approach to absolute comfort in railroad travel.

Discussing Car Ventilation.

At the January meeting of the Western Railway Club, President Hickey in the chair, a paper on Car Ventilation was read by Mr. W. G. Creamer. Mr. Creamer defined his view of proper ventilation and then proceeded to show that it was very rarely applied to railroad cars, and he freely expressed the opinion that railroad companies did not try to have their cars well ventilated.

Let us consider, said he, the problem. A railroad car is a thing of motion. Nearly everything about its construction is made with this in view. Movement is its normal condition. Why not use this movement to accomplish our purpose of ventilation, which, in our view in this case, is a mechanical process purely? Everything is possible in ventilation with power. Furnish the power and you can ventilate the deepest mine, the foulest dungeon, or darkest cavern. The moving car itself is the power for us. Nothing is added to the cost for our purpose. Now, we want to accomplish two things, in fact we must, or there is no ventilation. We must get fresh air in and foul air out. . . .

You must get fresh air in by some means, and you must do it without cold drafts; any method involving, or in any degree liable to, drafts is sure to fail. In fact, we must get the air in without the passengers knowing how it is done, unless they are inquisitive enough to inquire, and some will be, without doubt. We want the passenger to sit in the car wheeling along at 40 miles an hour in just as much comfort as in his own easy chair at home. He must not feel a suspicion of a cold draft, or the sense of smoke, or gas, or cinders, from the engine. If he gets out at a station for lunch, when he returns he must not smell a stuffy, confined atmosphere, but a fresh, well-aired room. We must establish and maintain a standard temperature, regardless of outside conditions. All the requirements of perfect ventilation we believe to be possible and practicable with a moving car. . . .

Our moving car at 40 miles an hour will take in the fresh air at the rate of nearly a thousand cubic feet a minute. We shall trap the cinders, and drive them out nearly as fast as they come in. This small whirlwind of fresh air we will warm by contact with the heating apparatus, whatever that may be, and then distribute it all around the car—not in one place, but in 30 or 40. Each passenger may have his own register if his fancy desires to control it.

In summer we would cool this air, when the mercury is drifting about the nineties. In fact, I think it quite within the possibilities to make the moving railway car the most pleasant place possible in summer as well as in winter; and that the passenger can leave his car as clean and well conditioned at the end of his journey as when he began it.

Accomplish these results and a railway journey will be a thing of luxury and pleasure, to be sought for rather than dreaded. Passenger travel will be increased by every effort that is made to promote the comfort of those who travel. That portion of the population of this country that travels for pleasure is increasing very rapidly, and it pays to recognize this fact and cater to it. Nothing that costs so little will so well accomplish this object as perfect ventilation.

Thus far I have spoken only of getting fresh air into the car, but to get the fresh air in the spoiled air must be got out. The exit must be, I think, on the sides of the clear story, with apertures 3 or 4 feet apart. These apertures must not admit air or cinders, smoke or rain. They must have the function of exhaust at all times, whether the car is stationary or moving. They must be the coefficients of the inlets, and the inlets will be the coefficients of the outlets. Each is as necessary to the other as the blades of a pair of scissors. . . .

I have spoken entirely of a car in motion. Cars filled with passengers are, however, often stationary and at times for prolonged periods. For such conditions I know of nothing better than open doors or windows. Our power ventilation then stops and we must resort to the same methods we would use in a house. I will only add in conclusion that a car fully equipped with a system of power ventilation on the lines I have shadowed forth in this brief paper can be as perfectly regulated and controlled as to temperature and atmospheric conditions, and with as much ease, as can the flow of water through a pipe by the handle of a faucet.

A long discussion followed the reading of this paper. Some of the speakers favored regulating the ventilation of cars by the forcing action of injected air, while others advocated systems that exhausted impure air, the void being filled by natural pressure. The prevailing opinion was that ventilation and heating should be worked in combination. Several of the speakers who were interested in improved methods of ventilating cars spoke rather strongly against the evils of defective ventilation. The discussion was, on the whole, very fair.

The Chicago, Burlington & Quincy mechanical department have designed a compound locomotive which they expect to build soon. The engine will be of about the same general dimensions as the class mogul passenger locomotives described in the NATIONAL CAR AND LOCOMOTIVE BUILDER of February, 1888. The high-pressure cylinder will be 19 inches and the low-pressure cylinder 29 inches diameter. They intend using a cast-steel piston in the low-pressure cylinder to keep down the weight. The valves will have a travel of six inches. The high-pressure valve will have $1\frac{1}{16}$ outside lap and the low-pressure valve $\frac{15}{16}$ inch. Both valves will have $\frac{1}{8}$-inch inside lap. In full gear the lead of the high pressure valve will be $\frac{1}{4}$ inch and that of the low-pressure $\frac{3}{16}$ inch. The engine will not differ materially from the Schenectady compound locomotive illustrated in this issue.

Acknowledging the True Value of Inventions.

Mechanical officers of an inventive turn cannot be too careful in watching for shortcomings in devices which they have patented, for the shrewdest of men are liable to be deceived about the value of inventions which they have devoted thought and labor to developing. Railroad companies have undoubtedly wasted large sums of money on inventions in which their own officials were interested, personal influence being the lever that held the devices up for notice and approbation. On general principles, it is a good plan for inventors not to permit themselves to be the judges of the utility of their own patents when they are in the position to influence the adoption of them by the company they serve. One occasionally meets with inventors who are rigidly just in scrutinizing the performance of their inventions, but this is the exception rather than the rule. Mr. Eaton, who was long a master mechanic on the Grand Trunk was a man of this sort, and some amusing stories are told of how he dealt with promising inventions which he had patented. Like many other engineers familiar with the losses that result from the employment in the cylinder of saturated steam, he concluded that great saving would be effected by the use of a good superheater. After cogitating over the subject for a long time he designed a superheater which was to transfer a portion of the heat contained in the gases passing into the smoke box to the steam while on its way from the boiler to the cylinders. The arrangement was very ingeniously designed, and the details of construction were marked out with consummate skill. All the heat to be used was to be taken from gases running to waste, so the whole of the saving would be clear gain. There would be no obstruction to the draft, and the superheater could be made cheaply. It looked to be the greatest improvement that had been made to the locomotive since the tubular boiler was invented. It appeared to be absurd to suppose that the saving could be less than 30 per cent. of fuel.

A good standard engine was selected for making the tests that would demonstrate the great value of the superheater. The performance of the engine was first carefully tested before any change was made, a record of the coal and water used in making the ordinary runs having been taken. The superheater was then applied, and Mr. H. Tandy, who is now suprintendent of motive power of the New York, Ontario & Western, was appointed to ride on the engine and supervise the tests. At the end of two weeks he submitted a report, to the effect that the superheater had not effected any saving worth mentioning. When the report was brought to Mr. Eaton he looked it over carefully, and remarked to Mr. Tandy: "You are certain that the figures are correct?" On being assured that they were correct, he walked to the round house where the engine was, and directed the foreman to take off the superheater. He waited around till the device was removed, then directed that it be taken to the scrap heap and broken up. He did not appear to be satisfied till he saw a blacksmith's helper reducing the apparatus to cupola scrap.

On another occasion Mr. Eaton invented a spark arrester composed of cast iron projections that would grind the sparks to powder in their way through the stack, and would obviate the need for cone and netting. He rode on the engine a few miles at night after this device was put on, and when the locomotive returned to the shop he gave himself no peace until he saw the blacksmith's helper with a twenty-pound sledge curing the defects of the spark grinder that refused to grind.

This promptitude in accepting failure is in pleasing contrast with the actions of many other inventors who will, in their blind adulation of their own mental progeny, strain the whole resources of a company to compel success where failure is inevitable and apparent to every unprejudiced judge.

Hanging Brake Gear.

Figs. 1 and 2 of the accompanying illustrations show a way in which brakes are applied to freight cars just being built, of 60,000 pounds capacity, of one of the largest railroads of the South. It will be seen that the brakes are swung to the body of the car. There are trimmers, or cross pieces, tenoned into the sills, to receive the eye-bolts which connect with the hanger irons. These hanger irons are 1 inch in diameter; the top is hooked into the eye-bolt, and the bottom is shaped like a stirrup, which connects with the brake head. This is evidently quite a serious mistake, from the fact that either the brake itself or the hanger iron, from the continual bending back and forth, must ultimately break. The writer, after seeing several of the brake heads and hangers broken, measured the radius of one of the curves these cars traveled over, and found it to be 130 feet. He also measured the distance between the center of the eye-bolt in the trimmer, and the center of the tread of the wheel while it was standing on said curve, and found it had been thrown over 6¼ inches. When the car travels over an opposite curve, the center of eye-bolt will be thrown 6¼ inches in the opposite direction, making the point at the eye-bolt travel 12½ inches, while the point at the bottom of the hanger iron, where it connects with the brake-head remains stationary while the brakes are being applied. It is, therefore, very plain that the connection, being straight instead of curved, is compelled to either break the brake head or bend the hanger iron back and forth from time to time until it breaks.

Fig. 3 shows the action of the brake arrangement while traveling reverse curves, providing the brake head will withstand the hanger iron.

Fig. 4 shows the way the beam will hang, if let follow its own inclination, while on a curve of 130 feet radius; and it is suggested that the draughtsman in getting up his car would lay down one of the quick curves of his road, or perhaps a better plan would be to lay down a curve of about 120 feet radius, as this is about the smallest in ordinary practice, and then lay down his brake arrangement upon it in order to see just how the curves will affect it. A few hours, more or less, spent this way upon a drawing may sometimes save a company thousands of dollars, not only in breakages but also in lawsuits, for if a heavy brake beam becomes wrenched from its fastenings it must necessarily fall upon the track, and perhaps wreck the whole train and cause death to some of its crew. A perfect working brake arrangement is the most important thing about a car, and the greatest care and judgment should be exercised in its construction.

Figs. 5 and 6 show the way the brake arrangement will act if the connections at the brake head are flexible instead of being rigid. This may be accomplished by simply extending a portion of the back of the head sufficiently high to form an eye to receive the bottom end of the hanger iron, which is shaped as shown. There is no necessity of welding the eyes in the hanger irons. An eye with the end butting hard against the body of the hanger in a good shapely way will answer every purpose.

The demise of Mr. J. H. H. Wiers will be sad news to all who knew him, and they were legion. His geniality was one of his striking characteristics. He will be missed from the ranks.

It would naturally suggest itself that a corporation such as the Union News Company, composed as it is of well-known and respectable citizens, would see to it that only such books as would tend to elevate the morals of the land would be handled by them through their train agents. But it is a lamentable fact that books of the most questionable character, so far as their decency goes, are handled by them. The president of an Eastern road recently ordered off all of this class of books. This step might well be taken by other roads. It is disgraceful that this should be allowed to go uncorrected.

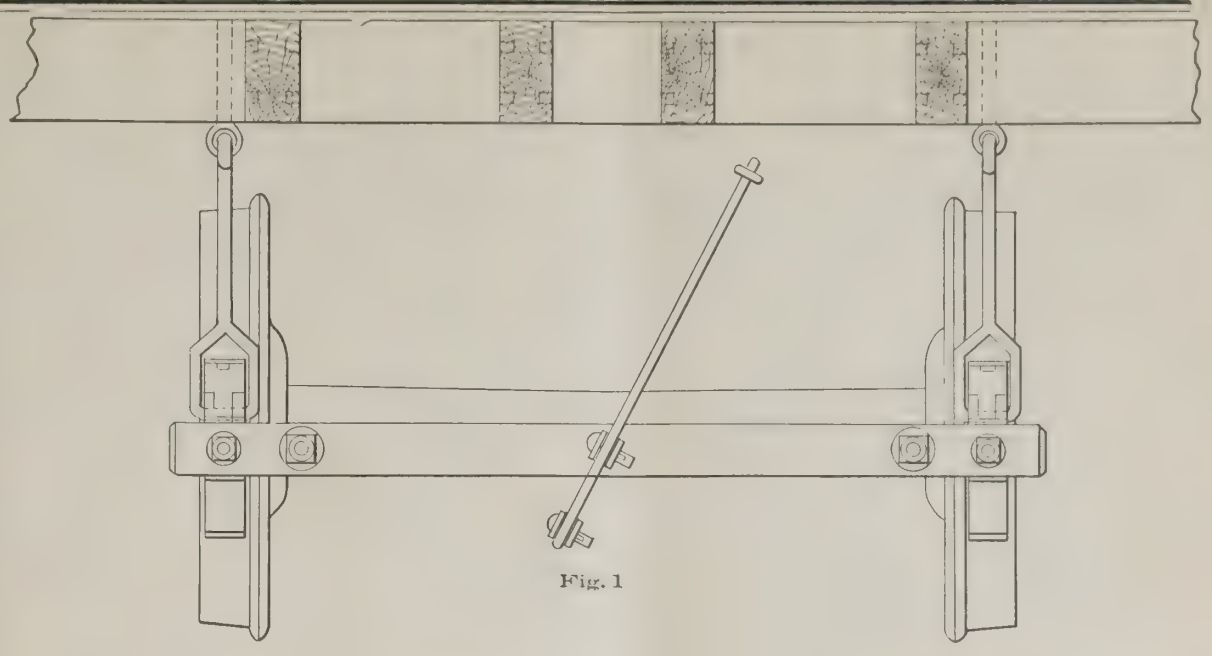


Fig. 1

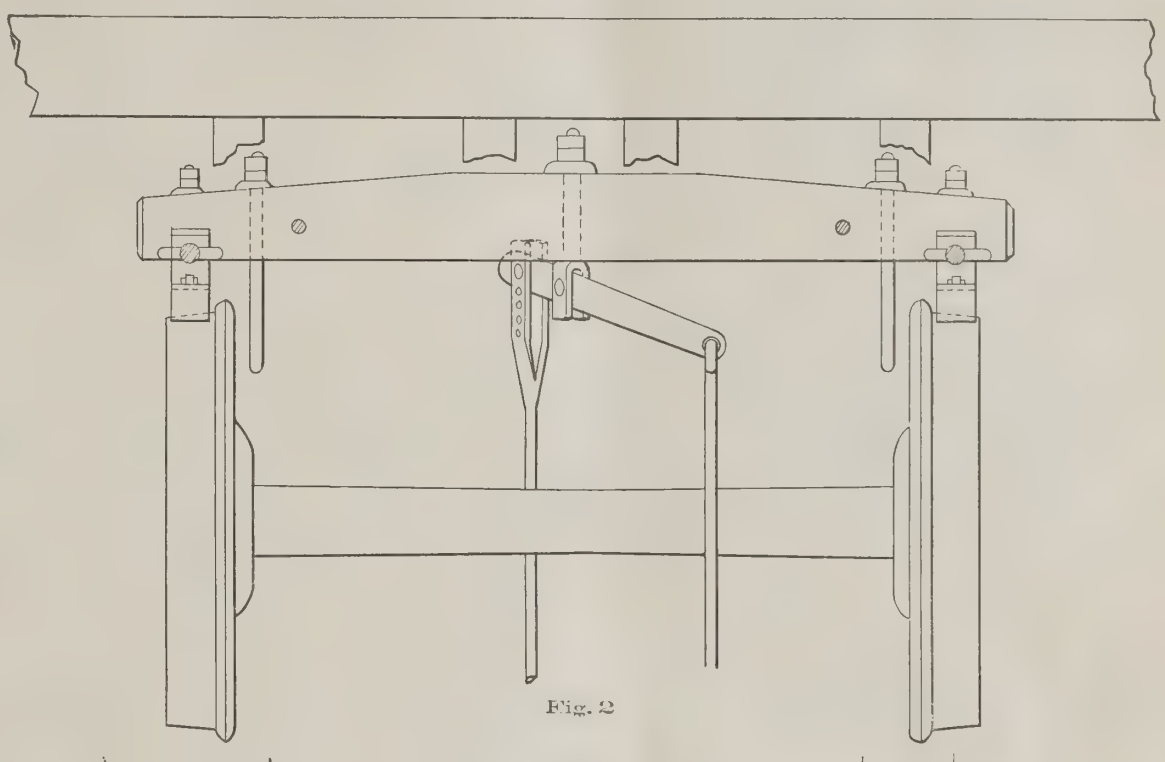


Fig. 2

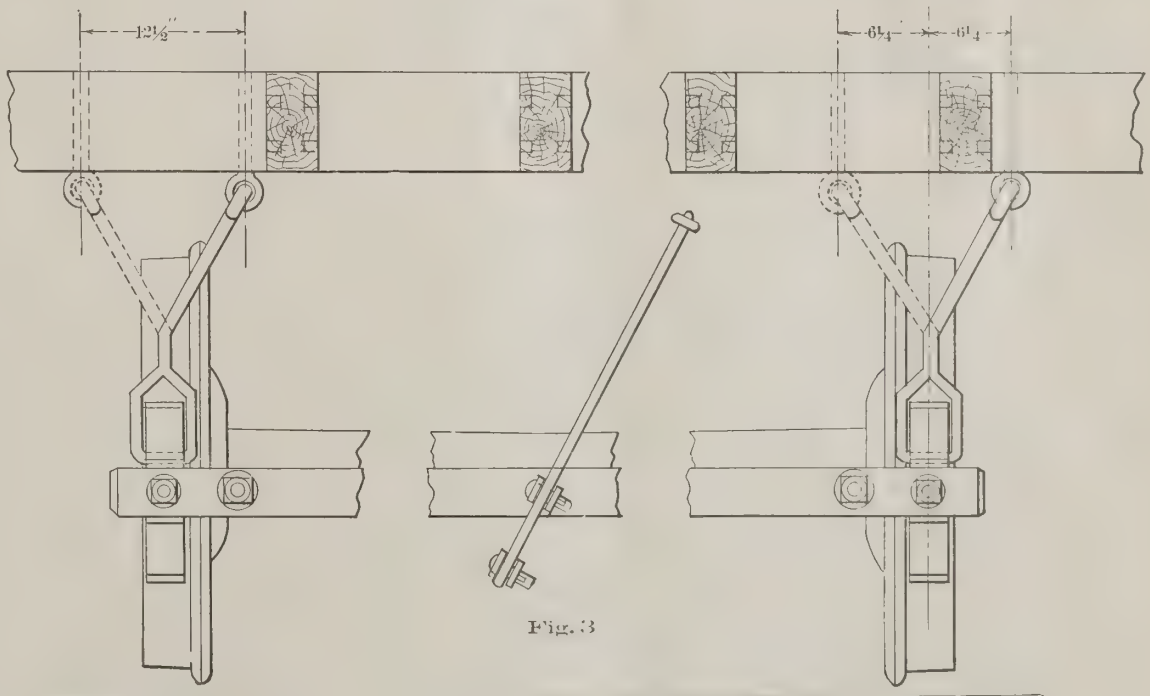


Fig. 3

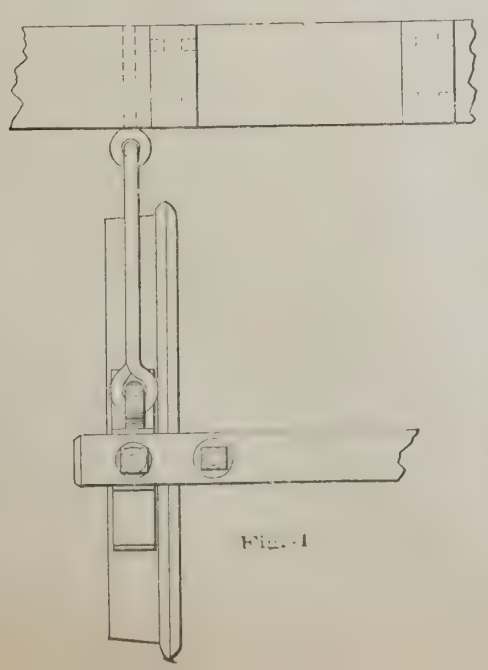


Fig. 4

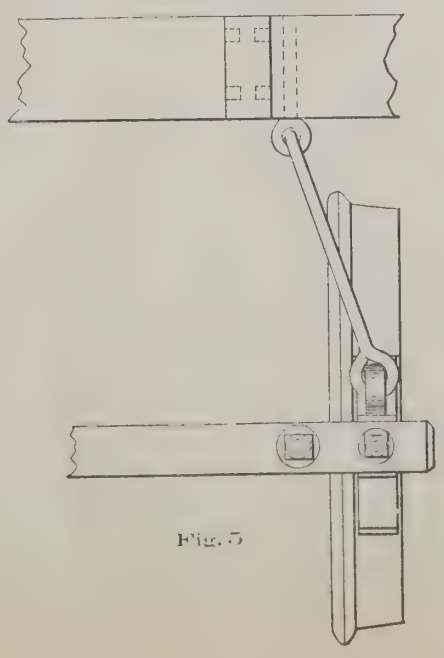


Fig. 5

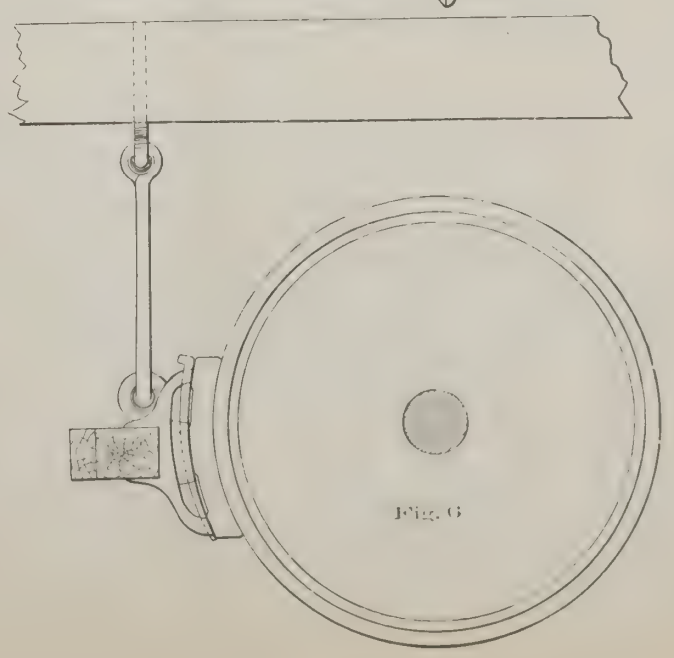


Fig. 6

Railway Car Construction.

BY WILLIAM VOSS.

Sixteenth Paper.

DIMENSIONS.

The length of the majority of passenger cars built during the last 15 years or more is 50 feet, and this has probably been selected as a standard because cars exceeding this in length are too heavy to be successfully carried on four-wheel trucks; there was so much trouble from hot boxes wherever it was attempted that the experiment had to be abandoned.

Some railway companies do, however, build longer cars, but they are almost invariably mounted on six-wheel trucks like the heavier sleeping cars. The usual length of the latter and kindred cars is about 65 feet, seldom less and frequently considerably more. The above figures represent the measurement from out to out of end sills, the platforms, exclusive of the protruding drawheads and buffers; add to these about 6 feet 6 inches.

The cross and vertical dimensions cannot, like the length, be altered at will, as they are subject to the conditions of the permanent structures of a road, such as tunnels and bridges. The width, measuring over the side sills, varies from 9 to 11 feet, the former being the width of the cars on the older Eastern roads, while 10 feet is probably the standard width in the West, where tunnels are the exception, and when they do occur are of ample proportions, because more modern. The width of 11 feet is used for chair and sleeping cars only, and then in but a very few instances. The width of the cars is increased 2½ inches at the bottom by the panel or siding boards and battens, and 4½ inches at the top by the letter boards and cornice.

The height of the cars is more uniform, probably because no particular advantage is to be gained by adding to it, and because a change in this direction materially increases the cost of overhead crossings, the number of which is constantly increasing. The average height from the top of the rails to the top of the clear story roof is about 14 feet 3 inches, to which 6 inches must be added for lamp jacks and other projections on this. The height at the side is 3 feet 6 inches or 3 feet 9 inches to the lower edge of the side sill and 7 feet 9 inches from this point to the edge of the roof.

The above, as well as all subsequent dimensions, refer to standard gauge equipment only.

FLOOR FRAMES.

These are constructed much in the same manner as those of freight cars, making due allowance for the altered dimensions and other conditions not present in the latter

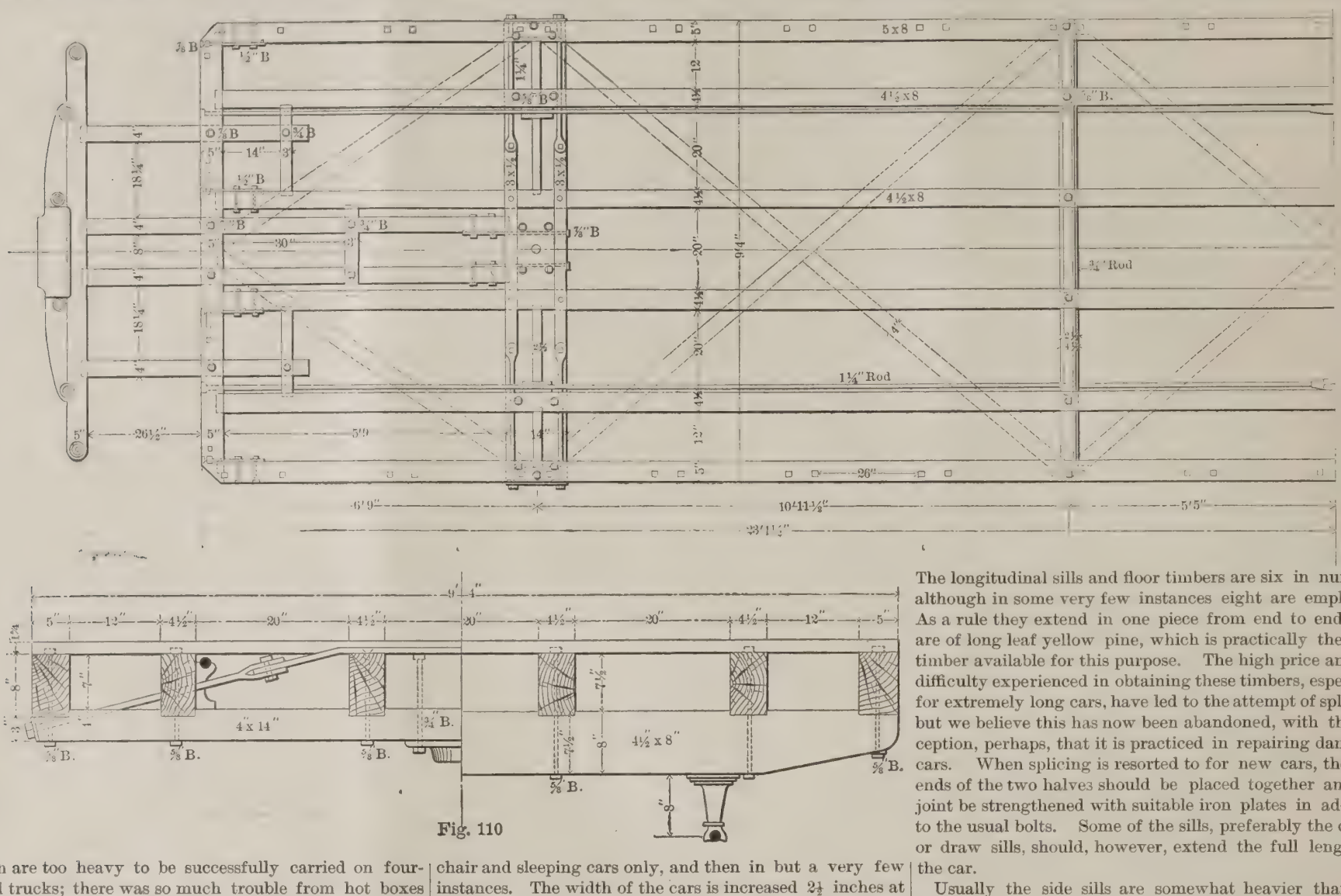


Fig. 110

The longitudinal sills and floor timbers are six in number, although in some very few instances eight are employed. As a rule they extend in one piece from end to end, and are of long leaf yellow pine, which is practically the only timber available for this purpose. The high price and the difficulty experienced in obtaining these timbers, especially for extremely long cars, have led to the attempt of splicing; but we believe this has now been abandoned, with the exception, perhaps, that it is practiced in repairing damaged cars. When splicing is resorted to for new cars, the butt ends of the two halves should be placed together and the joint be strengthened with suitable iron plates in addition to the usual bolts. Some of the sills, preferably the center or draw sills, should, however, extend the full length of the car.

Usually the side sills are somewhat heavier than the floor timbers, the dimensions being about 5 inches thick by 8 inches wide or deep, while the latter are 4½ inches thick, but of the same width unless the side timbers are rabbeted to receive the floor, in which case the floor timbers are the

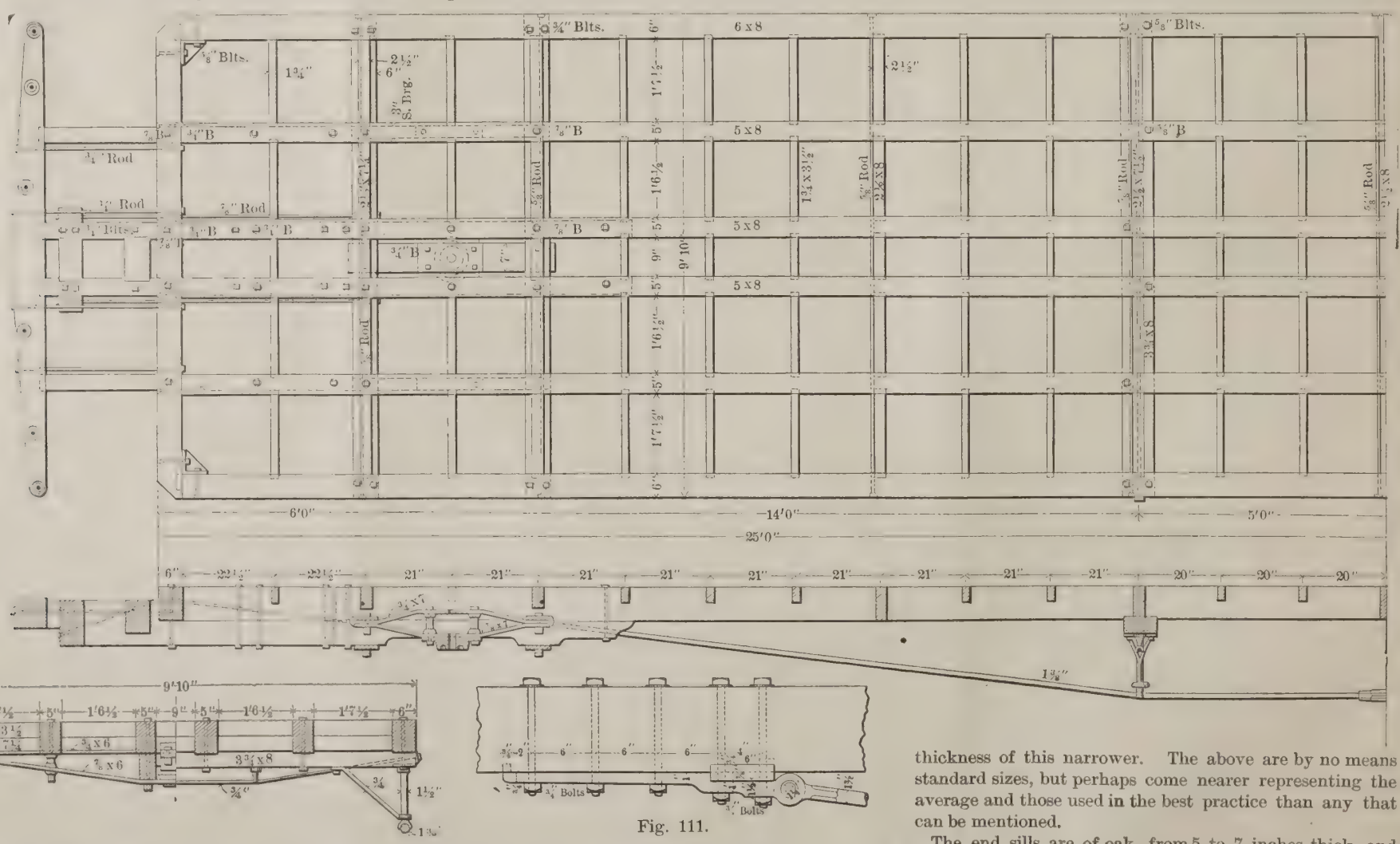


Fig. 111.

thickness of this narrower. The above are by no means standard sizes, but perhaps come nearer representing the average and those used in the best practice than any that can be mentioned.

The end sills are of oak, from 5 to 7 inches thick, and always of the same width as that of the side sills; they are framed to the longitudinal timbers with mortises and tenons in the usual manner, and are fastened with ⅞ or ⅞ inch lug or joint bolts, which are, however, not very numerous when the body truss rods extend to the end sill. An additional fastening is usually provided at its junction

with the side sill in the shape of an inside corner bracket of wrought or cast iron, which is attached with four or or more ⅝-inch bolts. Corner irons were formerly placed on the exterior, but as they are unsightly, of very little use as a protection, and productive of decay by holding moisture, they have generally been abandoned. The corners of the end sill are cut away, as shown in the different sketches, to permit the corner posts to extend to the bottom edge of the sills.

The end sills are very much exposed to moisture at the edge, as is the practice in freight-car construction, they are

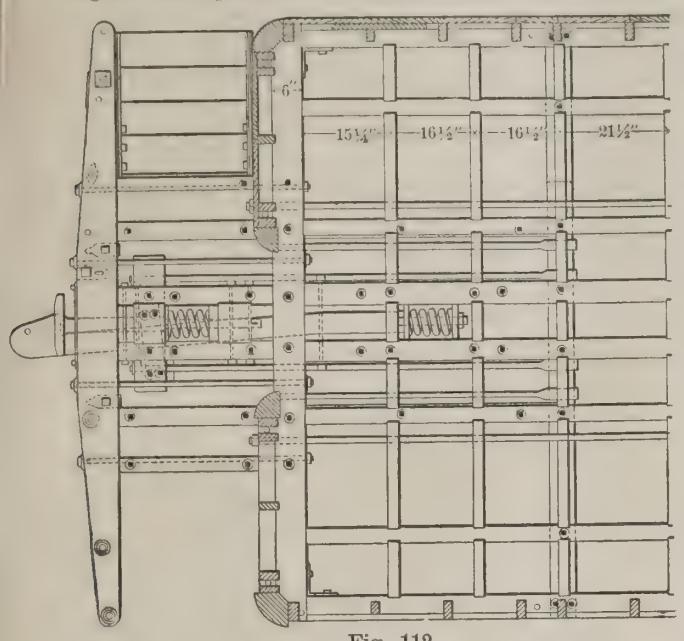


Fig. 112.

base of the doors, and are about the only part of the floor frame that suffers from decay; frequently they have to be renewed for this cause in less than five years. The construction, in Fig. 112, was adopted in at least one notable instance as a remedy. The improvement is practically a repetition of the change made when the corner iron was abolished; that is, the door posts, like the corner posts, extend to the bottom. The protection afforded by the extension of the posts is supplemented by a suitable change in the usual cast-iron threshold. To permit this extension of the door posts the end sill is moved in 3 inches and blocks of this thickness are bolted to it on each side of the doorway, which blocks support the end framing of the car; by using a 9-inch sill and cutting away the center portion these additional pieces may be avoided.

The body bolsters are located about 6 feet distant from the outer face of the end sills for four-wheel trucks and 8½ feet for six wheel trucks, and all the varieties employed for freight cars are used here also. When of wood—see Fig. 110—or of alternate pieces of wood and vertical plates of iron, they are from 4 to 5 inches thick and from 14 to 18 inches wide; they are secured to each sill with two or more ⅝-inch bolts and trussed with from two to four rods of a size corresponding to the weight of the car and the number used. Iron bolsters when used single are from 10 to 12 inches wide, and both the compression and tension bar are three-quarters of an inch thick. It is, however, much more preferable, although slightly more expensive, to construct a double bolster like that shown in Fig. 111, and this is invariably done where the car is mounted on six-wheel trucks. By the use of a double bolster the bending of the floor timbers at this point, which to some degree occurs in the best constructed cars, is reduced to a minimum. The space between the two bolsters, a distance of from 3 to 5 feet, is bridged at the center either by a beam of wood, a pair of 6-inch channel bars of iron or steel, or, as in this case, by a truss formed with ⅝-inch × 7-inch flat bars. To this the center plate is attached. The side bearings are also flat bars similarly shaped but smaller in section; they are according to length either ⅝ × 3 or ⅝ × 4 inches.

As a rule but two long truss rods are provided for the support of the center portion of the car, and these are of from 1⅛ to 1⅜ inches diameter, varying with the length and weight of the car. When applied the same as they are to freight cars, that is, when they pass through the end sills, they are located near the intermediate sills, but in the majority of cases they are placed directly under the side sills and terminate at or near the transom, the junction being made by means of irons to which the rods are coupled with turned steel pins, and which are securely fastened with three or more ⅝-inch bolts, not counting those passing through the bolster. This iron is reproduced on a larger scale to show its proportions more clearly.

The cross-ties are of oak about 8 inches wide and 3½ inches thick and are fastened with ⅝-inch bolts, two through each side sill and one through the floor timbers. As they are usually placed with the flat side up, and not on reinforced with a ¾-inch truss rod which is applied with cast-iron washer plates and bearings, as shown in one-half of the cross-section of Fig. 111. The main truss-rod post or bearing may be and sometimes is of cast iron, but more frequently of wrought iron. When of the latter material it has a diameter of 1⅛ inches and a length of from 8 to 12 inches measuring from the center of the rod to the under side of the needle beam. Its lower end is forged so as to form a seat for the rod, and the upper end with a dowel which enters a hole in a ½-inch bearing plate for this purpose provided and let in flush on the tie timber. The post is maintained in a vertical position by a forked brace or guide, which is secured to the timber with short ½-inch lag screws, but is not fast on the post. The truss-rod post in Fig. 113 was designed to avoid the turn-buckle necessary with all other forms. The threaded end of the post passes through a hole in the, at this point, enlarged and flattened truss-rod and the proper amount of tension is given this by the nut immediately above it; the second nut serves as a lock only.

Those parts of the floor frame that have as yet not been mentioned are conditional on the manner in which the floor itself is applied. If the boards are laid with joints crossing the longitudinal timbers like those of freight cars, or when the floor is composed of two separate layers, and the first or under course is laid as above, then the frame is like that in Fig. 110, which differs from a freight-car frame only in that at more or less frequent intervals there are cross-frame tie-rods and distance blocks. These blocks, which

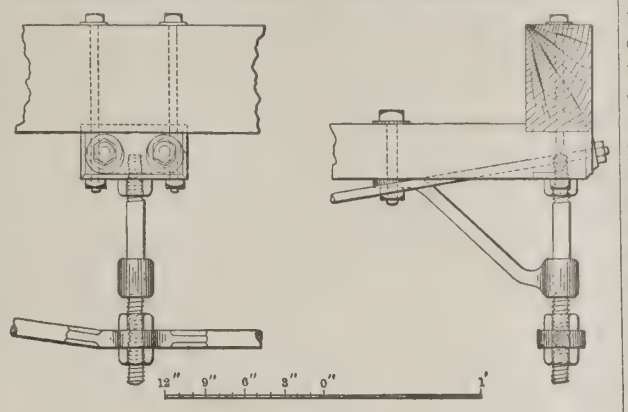


Fig. 113

are of the same width as that of the sills and about 2½ or 3 inches thick, are framed to the latter with mortise and tenon; the rod is usually ⅝-inch.

When the floor is laid with longitudinal joints and is single, a proper number of supports to nail it to must be provided. The usual method adopted in such cases is that in Fig. 111; the nailing supports are short pieces of 2 x 4 dressed or sawed to a uniform size of about 1¾ x 3½ inches, the kind and quality of timber being immaterial, and whenever possible, waste lumber is utilized for this. These pieces are framed to the sills with short tenons and correspondingly shallow mortises, and are applied at intervals of about 20 inches. Wherever the distance pieces previously described occur, as they do at every third or fourth space, they also serve as supports for the floor. A more simple method but one by which the floor timbers are more weakened, consists of nailing strips let in flush with the sills, to which they are secured with screws; this is not especially illustrated but indicated in Fig. 114.

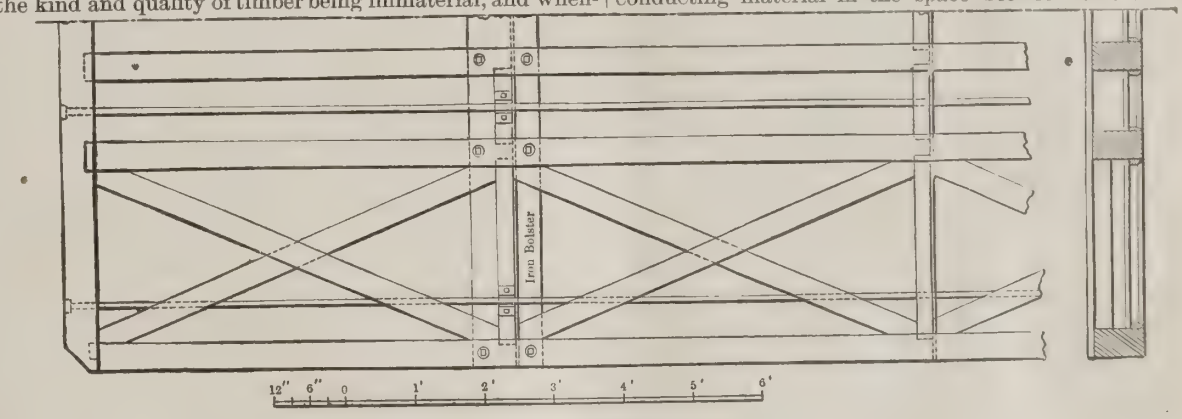


Fig. 114

To better preserve the rectangular shape and alignment of the frame, the older cars have a floor with diagonally laid joints, those in the upper course crossing the lower. This plan has not many advocates now for the reason that such a floor is difficult to renew, wasteful of lumber, unsightly when not covered by carpets, and in case the car be injured in a collision, it is frequently the cause of disturbing parts that would otherwise not be affected, this last because the two layers of floor act somewhat like a pair of shears; if a spreading occurs at the end it will invariably be reproduced at some point further on.

Ordinarily no special provision for preserving the original shape is now made; where it is thought necessary it consists of a system of diagonal bracing. In Fig. 110 the usual form of this is indicated by dotted lines; each of the panels formed by the distance pieces has a set of braces crossing each other at the center; they are 4 inches wide and 1¼ inches thick and should be of hard wood. The braces are let in flush with the top of the sills, which are cut at the junctions to a depth of 1 inch, the remaining ⅛ inch being taken from the braces themselves. Another method—if not quite so effective, has at least in its favor that it does not require any cutting of the sills—is shown in Fig. 114, which with the object of saving space, is made to represent only a portion of the frame. In this case there are two sets of braces, one on each side, and the space between the side sills and the intermediates has been selected because it is the widest. The braces cross each other, but do not interlock, and are not especially fastened; they are thick enough so that the pair fills the space between the floor and the deafening by which they are retained. They may be of white pine or any other light wood, so as not to unneccessarily increase the weight of the car.

The longitudinal timbers are usually spaced to meet the requirements of the draft and platform timbers, although in some instances this is ignored and the latter members depend for their support on the end sills, bolsters and the cross framing in that case provided. The location of the intermediates is governed by the wheels only when these are 40 inches or more in diameter, in which case they are placed in the same relative position as those of freight cars, but somewhat further removed from the wheel flanges to allow for the increased lateral motion on curves which is due to the greater length of the body and greater length of wheel base, especially of a six-wheeled truck. The distance of these timbers from each other should be four feet, measuring over the outside faces. Other parts of the floor frame, such as deafening, cross framing and braces, must also be arranged to be out of the path of these wheels.

The floors are now, with but a very few exceptions, laid with the joints running in the direction of the length of the car, probably because the center portion or aisle, which wears much more rapidly than the other parts, can in this case be renewed without disturbing the remainder or even removing the seats. The lumber generally used for this purpose is yellow pine in narrow strips, which, after being dressed and matched, measure ⅞ or 1 inch thick by 2½ inches wide on the face. Maple is not infrequently used, particularly for the aisle, on account of its superior wearing qualities, but yellow pine, if quarter sawed, as it always should be when used for floor boards, is almost as enduring and not so expensive. When the car has an under floor this consists of a cheap quality of white pine boards which are dressed and matched and about ⅞ inch thick. Wide boards are preferable for this purpose, as these brace the frame better.

The above has reference to the floors of passenger cars proper; those of baggage, express, and often postal cars also, are usually like those of freight cars, the kind, quality and dimensions of the lumber and the manner of application being the same.

Some provision is made in all passenger car floor frames both to deaden noise and protect the floor during the cold season. Frequently this is nothing more than a board ceiling applied to the under side of the sills, without any non-conducting material in the space between this and the floor. Formerly this was filled with shavings, but as this very inflammable material greatly increases the danger from fire in a wreck, the practice has been discontinued. Mineral wool has to some extent been substituted, but owing to the ensuing increase of cost never came into general use. In modern cars the deafening ceiling is covered with a layer of building paper, which is held in place by cleats or strips,

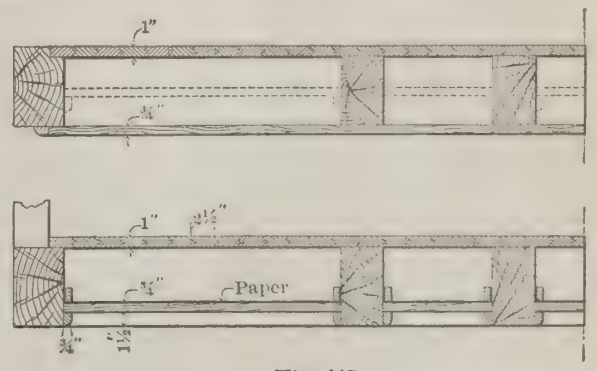


Fig. 115

and in addition, but principally in sleeping cars only, an intermediate floor also covered with paper is provided.

There are two distinct methods of applying the deafening ceiling, both of which are shown in Fig. 115. In the first of these the boards, which are of an inferior quality of white pine, dressed and matched and of the usual dimensions, are nailed to the lower edges of the sills and terminate several inches distant from the faces of the side sills, the ends being hidden by a quarter round molding. This is the simplest method and the best, because the ceiling applied in this fashion materially assists in stiffening the frame.

In the second instance the boards are cut to fit the spaces between the sills, and rest on cleats nailed to these. The strips mentioned as holding the layers of paper also serve to retain the boards. This method possesses the advantage that short and waste pieces of boards can be utilized. The intermediate floor is indicated by dotted lines in the first figure; it is applied in the same manner as the ceiling just described.

Communications.

Diameter of Smoke Stacks.

Editor National Car and Locomotive Builder:

Under the directions of Jas. Meehan, S. M. P., of the Cincinnati, New Orleans & Texas Pacific Railroad, an exhaustive set of experiments was carried out to determine the influence of the diameter of straight shot stacks on the steaming and economy of his road's engines. The standard stacks of this road were designed by the ordinary empirical rule that the diameter of the stack and cylinder should be the same.

Why the diameter of the cylinder should be selected as a correct diameter, more than the width of the bands on the jacket, the length of the engineer's foot, or most anything else, is not clear. If the stack has a relation it is much closer to the area of flue opening, grate area, etc., than anything else.

It can hardly be claimed that the cylinder measures the volume of steam exhausted from the stack, inasmuch as the point of cut off is the measuring factor, assuming that cylinders are 24 inches in length.

If, then, an 18 and 17-inch engine be hauling the same loads at same speed, with same initial cylinder pressure, using steam expansively, there would be a difference in point of cut-off, the exhaust pressure of the 17-inch engine being higher than that of the 18-inch engine, and, consequently, capable of greater expansion after leaving the exhaust nozzle, in which case it is difficult to see the relationship between the diameter of cylinder and stack. It is therefore evident that the pressure of the exhaust steam and its quantity would have a closer relationship to the stack area than the cylinder diameter.

Some of the later of Mr. Meehan's engines had smaller stacks than usual, as a 14-inch stack on 18-inch engines, the opinions of the engineers varying as to their value. Arrangements were made to measure the coal accurately and test the vacuum in smoke arch. It was believed before the tests that if the smaller stack was good for one engine it was good for all, the fact that some 18-inch engines had 250 flues and other older ones but 150 not being considered at the time.

The vacuum gauge with small stack showed a higher vacuum, which varied with the exhaust, acting as if a string were, figuratively speaking, attached to the vacuum, which was jerked with each exhaust. With the larger stack a lower vacuum was obtained, but very regular and even, as if the stack acted as an air chamber and equalized the vacuum.

On 18-inch engines with 250 flues the small stack did not improve the steaming qualities much, if any, as the large heating surface was sufficient of itself. The small stack, as might be expected from the higher vacuum produced, consumed more coal, there being a difference in favor of the large stack of 25 bushels in a run of 100 miles on 18-inch engines having 250 flues. On 18-inch engines having 150 flues the steaming qualities were improved, because the heating surface was deficient, the consumption of coal being increased. But a road afflicted with large business and a paucity of flues must not scan the coal consumption very closely, as it is a question of moving the freight and getting steam at any cost. On such engines the value of the small stack is unquestioned—it increases the vacuum in the smoke arch, and to satisfy nature's abhorrence of a vacuum a greater quantity of air rushes through the grates and fire, thus burning more coal, liberating more heat, and generating more steam—the end desired. It would, therefore, appear that the small stack, as far as economy is concerned, is a necessary mistake to correct the mistake made by the builder's parsimony in the matter of flues.

In the South the small stack—one commencing at the smoke arch with about the cylinder's diameter, tapering to a less diameter about 15 inches higher, and then tapering to a slightly larger diameter at the top, or running out parallel—is called erroneously the "Richmond & Danville Stack." Why, is not clear, as D. K. Clark, probably 40 years since, experimented in this direction, and his results, as shown in his "Railway Machinery," clearly show the greater vacuum due to the smaller stack.

Some roads have found that the smaller stack was economical in fuel, but as an engine which will not steam will "get away with"—I will not say *burn*—more coal than one that does steam well, the explanation for the improved economy may be found in this fact. FRANK C. SMITH.

Balanced Pistons.

Editor National Car and Locomotive Builder:

I have read with both interest and pleasure the letter in this month's CAR BUILDER from W. J. Thomas, about excessive wear of cylinders. My own experience leads me to endorse what he says about the excessive pressure that comes on the piston when the head drops down and wears a steam joint on the lower circle. The piston head when that happens acts like an unbalanced slide valve with the disadvantage that the piston has a much longer travel and has no exhaust steam coming up below to help balance the downward pressure.

Steam pressure is getting to be too high to run unbalanced valves, unless we are willing to face valves every month, and the same treatment is in order for pistons. It is a much more expensive job to bore out a cylinder than it is to face a valve, and I am constantly finding cylinders badly worn in the bottom that would not get out of shape so soon if the heavy piston was not constantly dragging there. When to the common drag there is added the wear that comes from downward pressure of steam, it is no wonder that we are all harassed with the weight of running repairs. Please put me down as a voter in favor of balanced pistons, but not any three snap rings on one piston for me. The middle ring in that kind of a piston is of the same value as a third wheel to a pony truck.

R. H. FOREMAN.

Publishing Club Proceedings.

Editor National Car and Locomotive Builder

I write to anticipate the action I feel sure you will take about the movement about to be made by the Western Railway Club on the practice of publishing the monthly proceedings. When the same subject was mooted some years ago, you were a powerful opponent of those who did their best to repress the publication of the proceedings, and I feel certain that you will repeat your old tactics, so I am trying to take time by the horns and convey to you the famous advice of *Punch* about marrying—viz., don't. I am ready to give reason for the faith that is in me, and will submit the following reasons why it would be better that railroad clubs should conduct their proceedings with doors closed against reporters:

1. The advantage to railroad men of clubs like the Western Railway Club and others is, that they are able to hold experience meetings. The facts given about different things often are the means of preventing men from repeating mistakes that others have fallen into. When everything a man says about the things he has tried and found to be no good are published in all the railroad papers, it often leads him to leave unsaid thing that ought to be said, and he omits putting out a caution signal to his colleagues because its appearance would be a canse of offense to some one whose interests are not identical with those of railroad companies. To put the case in a more tangible form—a certain oil box is put on the market which is reputed to be capable of saving 20 per cent. of the coal usually consumed in hauling the car, to say nothing of the oil that would remain in the dope bucket. Some of the general officers of a railroad exhibit a more than fraternal interest in this box, and the master car builder is advised to put it on the next lot of cars ordered. He does so, and keeps watching for the saving, but he fails to find it. Perhaps the box has been put under some cars merely at the urgent request of a supply man who is selling it and generally has good things to offer. The merits of this box come up for discussion at the club meeting, and the man who has it in use would like to tell the truth about it to the men present at the meeting, but he does not like to proclaim to the whole world his want of faith in the box, so he declines to rise when his name is called, and useful facts do not see the light.

2. General officers of railroads are often willing that their mechanical officers should attend club meetings and learn all that is to be picked up, but they do not like to see all the reading public made familiar with the affairs of their company as preached through the lips of their master car builder or master mechanic. There would be no objection whatever to the men saying what they felt moved to speak about the railroad, if what they said was not published.

3. The clubs ought to be training halls for railroad men to learn the art of expressing their thoughts in public. They are to a great extent fulfilling this object, but they would do it much better if the new speakers were not constantly oppressed with the embarrassing consciousness that the reporter was putting down their burning thoughts. It is perhaps a little hard to take from the world the benefit of these thoughts; but the people present at future meetings will receive more of the thoughts, when the wider publicity is cut off.

You and other railroad papers will no doubt be inclined to oppose the cutting off of reporting the discussions, because it gives you something to fill up; but I do not think that readers will object very strongly to having the club discussions cut off. I attend the meetings with mixed pleasure, and have a mild interest in what is said; but I do not enjoy reading club proceedings unless it be the small part that is occasionally devoted to reporting the wisdom that drops from my own lips. The only parties that will have reason to feel aggrieved by the suppression of the club proceedings are those who delight themselves by the hour proclaiming how many words can be used in saying nothing, and those who persistently attract attention to their own personality by asking silly questions about matters every train boy is familiar with. You cannot make a change without hurting the feelings of some one and causing disappointment to others, but it is for the interest of railroad men that the publishing of club proceedings should be abolished, and that ought to bring your support. CHICAGO.

The New York, Ontario & Western have placed an order with the Dickson Locomotive Works for 25 moguls, Mother Hubbard type of fire-box, for the new line now building between Hancock and Scranton.

The Action of Brakes.

Editor National Car and Locomotive Builder:

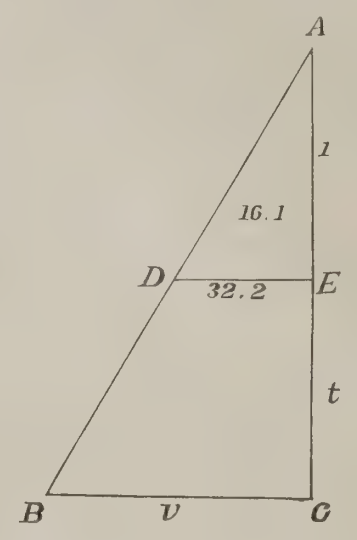
It is sometimes desirable for the car-builder to know just what effects should be accomplished by the brakes that he is applying to his cars, in order that the proper adjustment of levers may be made and the stop effected from a given speed in a predetermined distance.

The theoretical retarding action of brakes upon the wheels of a moving car is similar to that of the attraction of gravitation upon a ball thrown into the air.

The solution of problems in gravity is exceedingly simple, and can best be explained by reference to the accompanying diagram, which is based upon two well-known geometrical theorems, namely: That the sides of similar triangles are proportional to each other, and that their areas are proportional to the squares of their homologous sides.

With this understanding draw the right-angled triangle $A\,B\,C$, and from any point on the vertical $A\,C$, draw $D\,E$ parallel to $B\,C$. Then according to the theorems referred to

$$A\,E:\ A\,C = D\,E:\ B\,C \quad (1)$$



and

$$\text{area } A\,B\,C:\ \text{area } A\,D\,E = A\,C^2:\ A\,E^2 \quad (2)$$

In the triangle $A\,D\,E$, let the vertical $A\,E$ represent the time of one second; its area the space through which a body will fall in one second or 16.1 feet, and the base $D\,E$ the velocity per second acquired by a falling body at the end of one second or 32.2 feet. Further, in the triangle $A\,B\,C$ let the vertical $A\,C$ equal the duration of the fall in seconds and designate it by t; the base $B\,C$ equal the velocity acquired per second at the end of t seconds; and the area will equal the whole space fallen through in the t seconds.

For instance, to calculate the distance that a body will fall through in three seconds, take the proportion (2) and substituting

16.1 for area $A\,D\,E$
3 (seconds) for t or $A\,C$
and 1 (second) for $A\,E$

we have

$$\text{area } A\,B\,C:\ 16.1 = 3^2:\ 1^2$$

or

$$\text{area } A\,B\,C = \text{distance fallen}:\ 16.1 = 9:\ 1$$

Distance fallen in 3 seconds = 144.9 feet

This much for pure gravity calculations.

It is well known that the effect of gravity is one of uniform retardation or acceleration, according as a body is rising or falling. In the first instance it acts exactly like the brakes upon a moving railway car, and the same law is applicable to both. It must be understood that if the force of the brakes, as applied, is less than the actual weight of the car, the retardation will be less than that effected by gravity upon a rising body.

This is expressed by Rankine ("Machinery and Millwork," p. 355), as follows:

"If the acceleration (or retardation) be at any different rate per second (from that of gravitation), *the force necessary to produce that acceleration* (or retardation) *bears the same proportion to the driven body's weight which the actual rate of acceleration* (or retardation) *bears to the rate of acceleration* (or retardation) *produced by gravity acting freely.*"

Conversely, if we know the retarding power, as we do in the case of brakes, we can readily calculate the rate of retardation by an application of the foregoing principles.

It has been found that it is not practicable to use a brake pressure exceeding 65 or 70 per cent. of the weight of the car, though some brake manufacturers claim that with their peculiar and highly developed appliances a pressure of 80 per cent. is permissible.

For the sake of simplicity let us take a brake pressure of 70 per cent. and include in the resistance thus set up the journal friction and resistance of the air.

Taking the coefficient of friction of the brake shoe against the wheel as .18, we have

$$.70 \times .18 = 12.6 \text{ per cent.}$$

of the weight of the car acting against it as a retarding force.

Comparing this with the formula for falling bodies, we

find that this force, if applied to a car at rest, would give it a velocity, at the end of one second, of

$$32.2 \times .126 = 4.06 \text{ feet per second,}$$

or, inversely it has a retarding power of 4.06 feet per second on a moving car when applied through the brakes.

To take an example. On this hypothesis, in what distance could a train, moving at the rate of 40 miles per hour, be stopped on a level track by the application of the brakes?

First, let us calculate the time required to make the stop. Forty miles per hour is 58.66 feet per second. Hence the *time* required to make the stop would be expressed by the equation

$$\frac{58.66}{4.06} = 14.45 \text{ seconds}$$

Applying the same formula as in the case of gravity, where the final velocity (or initial in case of a rising body) is multiplied by half the time, in order to get the distance passed through before reaching a state of rest, we have:

$$58.66 \times \frac{14.45}{2} = 424 \text{ feet.}$$

There are, of course, other elements that enter into the stopping of a train, such as the grade, condition of the wheels, rails, etc. But the foregoing will be found to be accurate for calculations of brake resistances.

It would be interesting to make a comparison between the theoretical results as obtained by this formula and those obtained in actual practice at the well-known Burlington tests, and later on the 50-car Westinghouse train that made a tour of the country. Unfortunately, there is no record of the percentage of brake-pressures relatively to the weight of either the cars or the engines; so that, by taking the report of the trials, and reversing the order of procedure, we could simply calculate what the percentage of brake-pressure should have been, with everything working normally; and this would be convincing just in proportion as the reader puts faith in the results of theoretical deductions.

In the simple case given above, we have taken it for granted that all the brakes were applied simultaneously, and with their maximum pressure upon every car of a train as well as upon the locomotive. This is, naturally, impossible, owing to the probable inequality in the weights of the cars and their loads, even though the action of the brakes should be instantaneous.

Again, it is necessary to proportion brake leverage for empty cars. So, if we take a car weighing 23,000 pounds and proportion our brake levers to give 70 per cent. pressure, we have 16,100 pounds brake pressure, which is only 25½ per cent. of the loaded car, if its capacity be 40,000 pounds. This would increase the distance traversed by 2.7 times, so that the same car would travel 1,145 feet instead of 424 feet, when loaded, before stopping.

It would be needless to enlarge further upon this theoretical action of the brakes of a railway car, for enough has been said to show how exceedingly simple the law governing this action is, and how far removed it is from the abstruse calculations of higher mathematics. G. L. FOWLER.

Slow Passengers.

The stops made by the trains on the elevated railroads of New York occupy on an average seven seconds; the stops made by the trains on the underground railways in London occupy on an average 33 seconds. The number of passengers going on and off at stations is about the same on the elevated as on the underground railways. The carriages used on the underground lines are entirely of the compartment type, with at most 10 persons to enter and come out of each door. The elevated railroad cars have two doors to about 60 persons. With the arrangements for handling the passengers on the two kinds of cars it looks as if the English passengers would be got in and out as quickly as that kind of freight can be moved. Yet the English trains are nearly five times longer in handling their passengers at a station than the American roads.

Strange thing, that; what is the cause of the difference? Signals, crowded lines, red tape?

Not at all. It is the Englishman who will not be hurried by any impatient railway servant. It is the nation's inalienable legacy to every free born Englishman that he may take his time.

It is amusing and edifying to stand round an underground railway station, and watch the deliberate manner in which John Bull exercises his birthright in taking possession of a seat or in leaving it. And with what bated breath the "porters" invite the passengers out or to be seated.

It is scarcely amusing at times to get blocked by the deliberateness of the natives. One occasionally finds a rustic American slow in getting his wants explained at a ticket window, but he has to go to England to hear protracted particulars of family history communicated by purchasers of tickets.

I witnessed a funny scene at a busy junction in Lancaster one forenoon. A big, hearty, well-fed gentleman who appeared to be a well-to-do farmer, something of the John Brodie type portrayed by Dickens, took possession of the ticket window and asked when the next train for Marsden would arrive.

"At 10:57," replied the clerk.

"At 10:57," repeated Mr. Brodie, trying to twist his eye far enough into the window to see the clock. "10:57 is three minutes to 11; why don't they make it even, young man?"

"Train due in two minutes; let the other passengers get up to the window," exclaimed the clerk, impatiently.

"Softly, my lad," said Mr. Brodie," I may want a ticket myself. Art ee sure this train stops at Marsden?"

"Quite sure."

"Don't be snappish, young man. I like to make sure. I ain't going to be like neighbor Crump, who started for Slaithwaite and landed at Huddersfield," and the funny old gentleman shook with laughter as he thought of his friend being carried past.

By this time the train was coming in and the other passengers were calling out that they wanted tickets. But the big man who had got possession of the window held the fort, and assured the impatient crowd that there was no hurry. He asked for a ticket at last, requesting to know the price. When he had carefully examined the piece of pasteboard, and read over the information it contained, including the date, he began pulling out a purse from the profoundest recesses of his nether garments. The purse was about twelve inches long and it had compartments for different kinds of coin.

After carefully examining each piece, the money was handed to the clerk, and then the man began to ask questions about return trains. But when he was engaged with his purse one of the impatient travelers slipped between the big man and the window, and the ticket clerk began selling tickets. By this time the porters were yelling to the passengers to take their seats, the guard was complaining to the station master that his clerk was booking passengers after the arrival of the train, and great excitement prevailed. But it did not extend to Mr. Brodie. He looked very deliberately for a compartment that suited him, and as the train moved away several minutes late he was trying to get the guard to step up to his carriage and tell him something about the time of returning trains.

Pressed Steel Car Frames.

At a recent meeting of an English engineering society a description was given of the method of making solid pressed steel car frames under the Fox system. As this is the system which the Fox Pressed Solid Steel Company, of Chicago, are introducing into this country, the description will interest our railroad men. The author said:

The steel is made by means of three 15-ton Siemens-Martin furnaces, and at the plate mill, where the ingots are heated, hammered into slabs, and then rolled into plates. The plates are then taken to the pressing department, which is a large building, having an area of 124,800 square feet, where they are heated to redness, placed between dies, and subjected to a steady hydraulic pressure of 850 pounds per square inch. The materials used are chemically tested as they enter the works, and the products are tested, both chemically and mechanically, at every stage of manufacture. In the steel, so far as the chemist is concerned, the object is to get .10 of carbon. Mechanically, it must stand a tensile strain of from 24 to 26 tons per square inch, with an elongation of from 25 to 30 per cent. in 10 inches. In the bending test the steel has to stand the temper test prescribed by the Admiralty, the Board of Trade, and Lloyd's. Summing up the practical advantages of the system, the author observed that while the ordinary wood and iron frame weighed four tons 14 cwt., Fox's pressed frame only weighed three tons 14 cwt. Hence a saving of one ton of dead weight hauled, the lighter car being well able to carry all that the heavier one did. Another advantage was that whereas wood frames were valueless at the end of the car's life, the value of the steel frames as scrap was always that of pig iron. Other advantages were interchangeability, duplication of parts, and longer life in rolling stock on account of elasticity of the frames. Fewness of parts was also an important feature, there being only about 14 parts in one of the Fox's frames as against 47 in frames as ordinarily constructed.

Car frames of this material are not likely to be wanted in this country, but the material shaped in the way described ought to make excellent truck frames. The Chicago company mentioned have several forms of truck frames that they are about ready to put on the market.

Cost of American and English Locomotives.

When American locomotive builders have succeeded in obtaining contracts for building locomotives for British colonies in open competition with British builders, it has repeatedly led to acrimonious discussions in British engineering journals, and the claim has always been made that American locomotive builders are able to compete with European rivals only by using cheap and inferior material. The claim made by American builders that their superior mechanical facilities enabled them to do the work cheaper than European builders was always ridiculed and called absurd. Yet it is undeniable that when a first-class American locomotive builder undertakes to construct locomotives for foreign countries and equips them with wrought-iron wheel centers, copper fire boxes and other expensive material called for by English prejudices, he can still beat the European builders on price, although the latter makers do not pay half as much for labor as what is paid in America.

In spite of the low wages paid to skilled mechanics n Glasgow, the cost of building a locomotive there is considerably higher than it is in the United States. When Bret Harte was American Consul in Glasgow, one of his reports to our government brought this fact out very decidedly, but the accuracy of his conclusions was questioned by those concerned in promoting British interests. We recently learned something that appears to strongly corroborate the correctness of Consul Harte's conclusions. A British locomotive building company noted for the fine equipment of tools used and the advanced system of production followed, built 200 locomotives last year while employing on an average 2,500 workmen; a well-known American firm in the same time built 300 locomotives while employing 1,400 workmen. Allowing 300 days for a year's work, the American firm puts the labor of one man for 1,400 days on each engine finished. At the same rate the British builder puts the labor of one man for 3,750 days on each locomotive sent out of the shop. The weight and power of the American locomotives greatly exceeded those built in the British shop. This is no hearsay matter. It was a comparison made by the chief executive officers of the two works referred to. The British firm follows largely the American practice of production by piece work, and the process of manufacture appeared to be very systematically carried on. There is, of course, a cause for the great difference in rapidity of turning out the finished machine. Many of our engineering readers visited British workshops last summer and watched the methods of manufacture in vogue. We should be pleased to receive the views of some of them on what they consider the cause of the difference in production.

Telegraph Communication between Trains.

Some people have believed that great advantages to safe train operating would result from the inventions which supply the means of telegraphing from moving trains, but we have never been able to see anything very useful or practical about it. Inventors appear to think, however, that millions can be made by schemes of this kind, and every month we hear of new inventions that are to put the various trains in as close communication with each other as the inmates of houses having telephone or sewing circle connections. The latest addition to the railroad worlds supply of these conveniences is one which provides a system of signaling by which trains, whether going in the same or opposite directions, signal each other when within a mile or two apart. This is accomplished by means of an electric wire between the rails and a battery in the cab of each engine, which also allows of telegraphic or telephonic communication between the engineers in the different engines. Under this system the engineers give notice to each other of their approach, and in case of a washout or broken bridge the engineer of the approaching train at once becomes notified of the danger in season to stop his engine and avert an accident. Experts of the class who are ready to indorse every invention have pronounced this the most important ever produced for the safety of passengers. A working model of the invention was exhibited lately in Washington, and the electricians and telegraphers present agreed that the system was remarkable for its simplicity and practicability for experimental purposes.

Cab Doors.

No one knows exactly why locomotive cabs are built with inward opening front doors. Some don't think about it because they never saw them hung any other way, and most of the enginemen of the country grin and bear the inconvenience, satisfying themselves that it is part of the business—a disagreeable part. When the doors are swung from the outside corner of the cab "in," the door on either side when partially opened to admit air makes a deflector to shoot all the air, smoke and cinders—especially cinders—across the cab and into the face of the man who does not want air—or cinders either. Many a fireman, wringing with sweat, is riding over the country cooped up in a cab that might be kept cool if it was not for the deflector that would blind the engineer. Front doors that open outward from the side next the boiler are not in the way of anything in the cab, do not become deflectors of dirt, and can be opened any desired amount and the air will go directly back through the cab for the benefit of the man who wants it, and without annoying the man who does not want it. The door then becomes a deflector to catch and deposit cinders outside the cab instead of inside, and while the outside opening door delivers air and dirt, in direct proportion to the opening, the inside opening arrangement delivers air in direct proportion to the opening, but all the cinders that strike the door. Some builders go so far as to put a small door in the lower panel of the door, so that the men can get air without so much dirt. It is cruel to prevent a half suffocated fireman from opening his front door for a little air because the engineer is cool enough.—*Locomotive Engineer.*

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

FEBRUARY, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

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Car Ventilation.

Except maintaining the temperature inside of cars at a point which will satisfy all requirements, there is no practical problem more difficult to solve in connection with the needs of the traveling public than that of keeping up a supply of fresh air within the car sufficient to replace that which has become vitiated by passing through the lungs of passengers. The discussion of the subject of car ventilation at the last meeting of the Western Railway Club has again directed attention to a theme that has been permitted to rest quietly for two or three years. If readers of railroad literature are not well informed on the requirements of car ventilation and of the difficulties encountered in supplying them, it is not because the subject has lacked ventilation; for it has been discussed from alpha to omega and back again repeatedly during the last fifteen years. Scientists have responded to invitations requesting them to explain the sanitory and scientific needs of the case, practical men have shown how far abstract requirements could not be complied with in ordinary service, and empirics have striven to prove that by their methods the impractical could be successfully applied. Professor Huxley and other eminent chemists have furnished data respecting the vitiation of gases which appear to prove that 2,000 cubic feet of fresh air per minute must be supplied to every car containing 60 passengers, if the people are to be preserved from the action of slow poisoning due to excess of carbonic acid gas in the air they breathe. As displacing 2,000 cubic feet of air every minute would mean the keeping up of a hurricane within the car, the slow poisoning is preferred to the rapid pneumonia, and travelers are allowed to suffer the dire consequences that proceed from the inhaling of foul air. In this respect people who ride in railroad cars are no worse off than those who spend their time in houses, for the average dwelling is generally worse kept up to the hygienic requirements than cars; but then the promiscuous public has obtained no purchased authority to find fault with the condition of their neighbors' rooms, so the burden of fault-finding is heaped upon the railroad cars.

If railroad companies, or other companies operating passenger cars should display the most intelligent interest in car ventilation and proceed vigorously to supply the quantity of fresh air that the service would stand, they would find the regulation of this supply a much more difficult problem than those having patented ventilators would lead us to suppose. The favorite method with inventors, and that which found most advocates at the meeting of the Western Railway Club, was that where air is forced into the car or exhausted out of it by the pressure due to the moving train. There are few moving bodies that go through the world at more irregular speeds than trains in motion, and the recurring changes of velocity make it a bad method for regulating air admission. If a train running at twenty miles an hour forces sufficient fresh air into the car to keep the occupants healthy and comfortable, there will be a serious excess of air at fifty miles an hour, and an unhealthy deficiency when the train is running ten miles an hour or under to the extent of standing still. The force and direction of the wind will also exert a very great influence on the admission of air through ventilators worked by the rush of air due to speed of train. One day there will be a side wind which gives only a limited supply, another day the wind will be blowing fiercely in the direction the train is going, which will practically cut off the air, and a third day there will be a head wind which will make the supply too liberal. We are aware that many contrivances have been invented to adjust the ventilators for the ever-changing conditions, but we have never seen any of them work satisfactorily. The recommendation made by the leading speaker at the club meeting that the windows and doors should be opened for the admission of air when trains were standing at stations was a curious one for a ventilation reformer to make. If doors and windows are good openings for the admission of air when a train is at rest, we cannot see that they would be so much worse when a train is running.

We think, however, that the opening of windows or of clear story sashes to admit air is a most crude and unsatisfactory way of doing it, and it is often made worse by the want of interest displayed by the average trainman in performing his work of regulating the supply of air to suit the temperature. Passengers pass as much air through their lungs when a train is standing or running slow as they do when it is running fast, and as the demand is constant it ought to be the aim of inventors to provide the means of making the supply constant. This cannot be accomplished by any mechanism operated by the running car and influenced by the changing velocity. Electricity is meeting with great and increasing success as a means of operating small motors for such work as ventilating fans. Why could not small motors be employed to drive ventilating fans for railroad cars, where the supply could be regulated properly and the fresh air carried over the surfaces provided for heating the car. With an appliance of this kind in use the admission of air could certainly be better regulated than it is at present, and it would provide facilities for taking air from the points least likely to supply a mixture of smoke and cinders. One of the speakers at the club meeting spoke of the practice followed in India of cooling the inside of a car by means of a revolving fan operated by hand. Modifications of that plan on modern methods, with an electric dynamo to drive it, might no doubt, be found a great luxury on the American continent.

Railroad companies and sleeping car companies can hardly be truthfully accused of displaying apathy toward the comfort or convenience of passengers, for no cost seems to deter them from adopting new inventions intended to increase the luxury or to add to the comfort of cars. If any perfected method of ventilation were offered that promised to make an entire success without causing overwhelming expense, we feel sure that it would be promptly patronized. To effect perfect success, a personal equation intervenes that will not harmonize. It is impossible to get the whole of the passengers in a car to agree on what is good ventilation. Some are twice as sensitive as others to heat and cold and atmospheric impurities, and as long as they have to be warmed and ventilated collectively instead of singly, there will be complaints. In fact, the greater number of passengers are perfectly satisfied with the way cars in most first-class roads are now ventilated and heated, and it is only for a discontented minority that changes are necessary. There may be more carbonic acid present in the air of a car than hygienic experts would consider healthy, but most people prefer comfort with warmth to health with a draft, and the majority rules even in traveling. Not one in a hundred of the passengers cares anything about the specific components of the atmosphere, or whether carbonic acid gas is deadly or nutritious. A car full of passengers, and all the places for admission of air is closed, is not a desirable place to sit in toward the small hours of a night spent with closed doors; but it is doubtful if people who occasionally pass days and nights in such a place ever really suffer in health from the ordeal. On the other hand, many people have suffered from severe colds, and others have died of pneumonia, induced by the drafts resulting from the tyranny of the fresh air crank who will persist in having car windows opened at unseasonable times.

Merits and Faults of the Link Motion.

Among the subjects selected for investigation by the Railway Master Mechanics' Association during the current year is "The Efficiency of the Link, Compared with other Valve Gears." It is safe to say that there are not ten members of the Master Mechanics' Association who entertain the smallest doubt of the superiority of the link for locomotive use over all other forms of valve gear; but this motion has been assailed so persistently and abused so ruthlessly by a certain class of writers and speakers, that it is a seasonable proceeding on the part of the men who are responsible for the continued use of the link to prove the wisdom of their choice. As the economical operation of a steam engine is dependent upon the manner in which steam is admitted to and passed out of the cylinders, the valve motion regulating this distribution has naturally attracted the attention of the greatest engineers and inventors, and it is doubtful if any form of valve or method of moving the same could be invented which has not already been tried. During one period of railroad history the inventions of valve gears for locomotives were nearly as numerous as new car couplers have been within the last decade. Railroad master mechanics and locomotive builders displayed great readiness to test the merits of the various valve gears offered as improvements, and nothing seemed too complex or too impracticable to be tried. After the most searching ordeal of experience, the link motion, as a survival of the fittest, remained without a rival for all kinds of reversing engines.

The faults of the link motion are strikingly apparent on the first superficial investigation of its action. To use the steam to best advantage, the theory is that it ought to be admitted to the cylinder promptly enough to make the initial pressure close to that of the boiler; this pressure should be maintained to the point of cut-off, after which event the steam ought to be permitted to perform work by expanding till close to the end of the stroke. On the return stroke the valve ought to remain open long enough so that the compression which follows closure will only be sufficient to cushion the shock due to stopping the reciprocating parts, and to compress the inclosed vapor up to initial steam pressure. To control the steam distribution in this way may be called the attributes of a perfect valve motion. There is a point of cut-off and a velocity of piston where a properly designed link motion gives nearly a perfect steam distribution. But it is readily found that when the link motion is notched up to cause an early cut-off, steam is badly wire drawn during admission, owing to contracted port openings, the periods of release and of valve closure are so much accelerated that the steam is released long before the end of the stroke is reached, and compression begins so early that the power-giving capacity of the cylinder is materially reduced. This sets the inventor to work to produce a motion which at short points of cut-off will give a good port opening, a protract release of steam till the piston has nearly completed the stroke and delay the valve closure to make the compression merely sufficient to cushion the moving parts—the theoretically perfect motion already referred to. Numerous valve gears have been invented which effected these requirements. In every case a great increase of mechanism was necessary to produce the desired operations, and in no instance has it been demonstrated that the steam was used to any greater advantage than with the theoretically inferion link motion.

The inventors who undertake the improving of the locomotive valve-motion generally take some high-class automatic cut-off stationary engine as their ideal, and proceed to work out a steam distribution for locomotives on similar lines. The distribution of steam in locomotive cylinders is influenced by condititions that are not present in any other kind of engine—conditions which nearly always defeat the efforts of inventors. The cylinders in the first place have to be made abnormally large to enable the engine to exert at starting or during a slow pull on a hill all the power that the adhesion will make useful. What are called the defects of the link motion have the effect of reducing the capacity of the cylinders when the links are notched up; but we have never yet seen a locomotive pulling a heavy, fast train which could not use up all the steam that the boiler would supply. The theorist steps in here and says, we will, by the use of a superior motion, distribute the steam in such a way that the diagram will show a nearly horizontal expansion line, a sharp point of cut-off, prolonged release and small compression, giving the same area of card produced by the link motion with less expenditure of steam. The practical man who has seen this repeatedly tried will agree that it *appears* to show a saving of steam, but he will generally add that engines so changed always burned more coal than formerly to do a given measure of work. The explanation of this is that earlier cut-off and reduced compression cause so much cylinder condensation that loss results where saving was anticipated. Compared with the size of the cylinders, the steam ports of a locomotive are too small to admit of maintaining a horizontal steam admission line with high piston speed, and it would be of little economical value if it could be done. There is no gain, but decided loss, in trying to protract steam release with most locomotives, for the exhaust nozzle restricts the exit of steam so much that at high piston speeds there will be serious back pressure at the beginning of the return stroke if release does not take place considerably before the end of the stroke is reached. In this part the link motion produces action as nearly perfect as could be devised, for it protracts the hold on the steam when the engine is working hard and slow, and releases it early when the engine is working fast.

The adversaries of the link motion have always pointed to the excessive compression at high speeds as a conspicuous defect which is beyond remedy. Where this compression has been controlled within certain limits, it has been found a decided gain instead of a cause of loss. The pistons and other reciprocating parts have to be brought to a state of rest at the end of each stroke. At high speeds these heavy parts contain a great amount of energy, which is stored up in compressing the steam to be given out as work during the return stroke. Absorbing the energy of the moving parts by means of compression decreases the friction on crank pins and journals because the compressed steam receives the pressure that otherwise would be brought upon them in arresting the motion of the piston and its connections. There are very good reasons for believing

that as the steam expands and passes out of the cylinder it loses a large percentage of its heat, producing a refrigerating effect upon the metal of the cylinder, leaving a comparatively cold vessel to receive the next charge of steam. Unless something is done to restore this lost heat, its equivalent will be taken from the entering steam with a resulting loss of useful effect. When steam is compressed in the cylinder, the records of experience go to indicate that it not only stores the energy of the moving parts to be given out again, but that the rise of temperature due to the compressing of the steam heats up the cylinder and materially reduces condensation at the beginning of the stroke. There can be no mechanical objection to compression when it does not rise higher than the steam chest pressure, and, when it fills the cylinder clearance spaces with steam of initial tension, it saves that volume of steam which would otherwise be taken from the boiler at each stroke.

There are locomotives at work in which the steam is very badly distributed by the link motion and lap slide valve. There is tardy admission, giving a low, effective cylinder pressure, slow and uncertain cut-off providing for a minimum of expansion and protracted release causing waste of power by back pressure. There is still considerable steam in the cylinder when early valve closure starts compression that shoots up above steam chest tension before the end of the stroke is reached, jerking the valve off the seat and obstructing the piston, causing the see-saw action common with locomotives that cannot be forced beyond a certain comparatively slow speed. A locomotive acting in this way does the work very expensively and with no satisfaction to any one connected with it. The blame of its shortcomings is, however, not with the link motion, but with those who have produced an extremely inferior design of a good device.

Smoke Stacks.

The letter in another column from Mr. Frank C. Smith, relating to the experiments made on the Cincinnati, New Orleans & Texas Pacific, with smoke stacks of different diameters adds an interesting chapter to the literature of a subject that has received less attention than its importance demands. The sum of the discoveries made is, that under certain restrictions a smoke stack of small diameter will, with a given exhaust nozzle, produce a higher smoke box vacuum than a larger stack, but that the small stack will lead to the greater consumption of fuel.

When the diamond smoke stack was used its diameter appeared to make very little difference to the steaming qualities of the engine, for with the low-set nozzles the lift pipe acted as the pump that forced the gases out of the smoke box. With the open stack the case is different, for the exhaust nozzle delivers the steam directly into the barrel of the stack, producing there the necessary draft. This ought certainly to call for some intelligent proportion between the size of the smoke stack and of the volume of steam or gases to be passed through it. Future investigators may be able to devise a rule for proportioning the smoke stack, but with present American practice of grate area, sectional flue area and size of exhaust nozzle, there appears to be no basis for establishing a proportion that would suit all locomotives. It is still quite a common practice to design the diameter of the smoke stack in relation to the diameter of the cylinder, but there is really little connection between the two, as has been pointed out by our correspondent, and the prevalence of the practice is no doubt due to the absence of a better guide. The experiments made with draft appliances more than fifty years ago by Mr. Daniel K. Clark supplied data regarding the most satisfactory diameter of smoke stacks, which have been regarded as authority by European engineers ever since; but our proportions of grates and flue area have changed so radically that the Clark proportions will probably not suit our engines. He found that the proper diameter of the chimney depended on the grate area and the flue section of the boiler; that within practical limits the larger the flue section and the smaller the chimney diameter, the larger could the exhaust nozzle be made. The conclusions arrived at by Mr. Smith are substantially the same, for if an engine steams more freely with a small stack than with a large one with a nozzle of the same size, the nozzle used with a small stack can safely be enlarged. Mr. Clark found that the best results were obtained with locomotives whose smoke stacks were one-fifteenth of the grate area, which is much smaller than the common practice here. It is certain, however, that our locomotive designers have generally made the stacks too large since the obstructions in the shape of cone and netting were taken out of them.

Restricting Reports of Club Proceedings.

The subject of restricting the publication of the proceedings has again been brought up at the Western Railway Club, and a committee has been appointed to consider the practicability of making public only such remarks as the speakers may desire. A valued correspondent, whose letter appears in another column, was kind enough to advise us of this action of the club before the report of the proceedings reached us. He is very solicitous that we should not permit ourselves to be influenced to oppose the movement to restrict the publication of the club's proceedings by our recurring necessity for something to fill up. We entirely appreciate the delicate way our friend has of stating his request, but we would emphatically protest that we are not troubled so much with want of something to fill up as with want of fuel, in the shape of time, necessary for boiling down the mass of "copy" that comes monthly to this office. The club proceedings are too diffuse for our readers, and a change which would condense them would be decidedly to our advantage. We can readily understand that discussions sometimes arise in club meetings which would be better left unpublished, and there are things sometimes said in the heat of debate that look harsh in "cold type," but it is a difficult matter deciding on what should be printed and what should be suppressed.

Some speakers do not express themselves so freely when a reporter is noting down what they say as they do when they know that their remarks will not be recorded, but this is the exception. Others may sometimes want to say something they do not wish to see repeated in print, but this does not happen very often. Our experience with public meetings convinces us that the great majority of speakers are anxious to have their remarks published, and we are very much mistaken if curtailing the publication of the proceedings does not prove highly detrimental to the interests of railroad clubs. It requires great care and no little skill to condense the remarks of speakers, and an ordinary shorthand reporter is not familiar enough with the technicalities of the subjects discussed at railroad clubs to make an intelligent synopsis of each speaker's remarks. This requires that a full report, if any, should be made, or that it be carefully edited by some one familiar with the subjects discussed. The latter plan is, we believe, impracticable.

Balanced Pistons.

In the NATIONAL CAR AND LOCOMOTIVE BUILDER, of July last, we illustrated a rather simple but efficient method, invented by Mr. W. J. Thomas, of the North Pacific Coast Railway, for balancing pistons. Since that time different correspondents have given their views on the subject of balancing pistons, and we believe to-day that there is a growing necessity for carrying the piston clear of the bottom of the cylinder, and that there is an inclination among master mechanics to inquire into the merits of anything offered for doing this work. In a recent communication to this journal, Mr. Thomas directs attention to the downward pressure put on piston heads through the bottom of the head wearing to a perfect joint, preventing the steam getting between it and the cylinder to effect a balance. We believe that this cause of excessive wear is much more common than is generally supposed, and our views are corroborated by a letter in this issue from a railroad officer, who has had long experience in charge of running engines. Anything that increases the need of repairs is likely to interest round-house foremen, and they will seldom err in diagnosing the cause.

Balanced pistons have been tried repeatedly and abandoned, but that is really no reason why their use is not demanded, for we have seen several well-known improvements that were emphatically condemned when first tried brought into popular use. The balanced slide valve is one of the rejected devices that has been proved of great merit. Locomotive pistons are now so large and they are made so heavy to resist the shocks imparted by the high pressure steam that the necessity for balancing them is becoming more apparent. The conditions of to-day may call for balanced pistons when such a thing would have been useless with the conditions that prevailed ten years ago. Those who are using exceptionally heavy locomotives are best able to tell whether or not balanced pistons are yet a necessity, and we should like to hear from some of them on the subject.

Gratuitous Tyranny.

The Philadelphia & Reading is nothing if not paternal with its employés, but the evidences of fatherly care are generally of the Draco order, that delights in inflicting suffering. Several decades of the most ruthless oppression appears to have crushed the spirit of resistance out of the men who have had the misfortune to be thrown, by force of circumstances, into the service of this corporation, whose methods would be a disgrace to Russian despotism. But the practice of meek submission to unmanly edicts does not appear to relieve the men from numerous new acts of petty tyranny. The average officer of the road appears to be above trampling wantonly upon the wretched employés, even when the spirit controlling the corporation encourages them to do so; but there is one superintendent, named Bonzano, who seems to delight in prodding new goads into the wounds which the blows from his iron rod always keep raw. This creature, some time ago, intimated that the Reading would tolerate no man in its employ who belonged to labor organizations, and an order soon went into effect which resulted in chasing all the men off the road who had failed to quit the brotherhoods. Encouraged by this success and the weakness of the men remaining on the road, this man has been pursuing a course which makes onlookers believe that he is trying to see how much petty tyranny American citizens can endure without revolting. The latest product of this animal's ingenuity for torture is the enforcing of an order that trainmen shall trim their beards after a special Reading formula. This followed an order regulating the buttoning of coats. The penalty of disobeying the idiotic orders of this asinine martinet is dismissal from the service This human terrier cannot torture the people who come in his way without the connivance if not the encouragement of his superiors. The Reading company has been practically ruined through fighting with the employés, and the officers now responsible for the acts of such contemptible reptiles as Bonzano, ought to remember that there is a limit to human endurance, even for men who have no union behind them. Apart from the disgusting immorality of the acts, senseless oppression is a very expensive luxury to indulge in toward railroad employés. We know of no employer who is more dependent on the hearty co-operation of its help than a railroad company trying to operate economically. With hostile help the richest railroad will soon find its way on the road to ruin.

Six More Unfortunates.

The present has been an extraordinarily mild winter, and no severe forcing process has been necessary in heating cars, yet the dangers of the red-hot stove have not been hidden. Several minor accidents have happened where the starting of fires by shattered stoves have blotted out a few human lives, but as we go to press the news comes of an accident on the Louisville, New Albany & Chicago, which is likely to stimulate a new public sentiment against a method of heating cars that has sacrificed so many victims. The latest accident is the repeating of an oft-told story. A train accident leads to the smashing of a car, the fractured stove sets fire to the wreck, and the unfortunate people caged in by the shattered timbers are burned up. In this instance six persons lose their lives. We suppose the management of the Louisville, New Albany & Chicago have kept the stoves in use under the belief that the present agitation in favor of safe methods of car heating would soon die out. Somebody will seriously neglect his duty to the public if the management of the road are not prosecuted for criminal recklessness in causing the death of the people killed in this accident.

The various railroad clubs are discussing in advance the changes to be recommended in the rules of interchange of cars at the next Master Car Builders' Convention. Discussing the rules of interchange of cars always takes too much time at the annual conventions, but the work done at the clubs last year greatly facilitated the labor of revising the rules. The changes called for this year appear to be fewer than usual, and it may be that the work done in advance by the railroad clubs and the executive committee will enable the members to finish discussing the rules of interchange within one day. Changes of the interchange rules is a subject particularly well suited for discussion at railroad clubs, for nearly all railroad men who attend these meetings are interested in any suggestions looking to accelerating the movement of cars, and nothing is brought up about the subject that is incomprehensible to men who are not mechanics. The suggestions of changes are then talked over, and the publicity they receive make their merits and shortcomings known. When all the pros and cons of a proposed change have been repeatedly discussed in club meetings, they are not likely to be tiresomely threshed on the floor of the annual convention.

The unusually heavy snowfall on the Pacific Coast during the month of January has brought into prominence the great value and efficiency of the rotary steam snow shovel. Whole divisions of track were snowed under to the depth of six or eight feet. No push plow could do anything with such an obstruction, and had nothing better been provided the roads would have had to remain buried till the snow could be laboriously shoveled out by hand. But the rotary snow shovels were set to work, and they soon cleared away the snow, throwing it from the rails and leaving a clear track. This method of handling snow is, to be sure, shoveling, but it puts a steam engine to do the work that thousands of hand shovels would perform very slowly. It is, however, the mechanical way of fighting with snow, and the recurrence of severe winters will in time teach all managers in charge of railroads within the snow belt that the steam shovel principle is the only way to handle snow efficiently and safely.

We have received the second volume of the *Locomotive Engineer* containing the numbers of that publication for last year. The paper is very ably edited by Mr. John A. Hill and is one of the most interesting and readable of the journals that come to this office. The first aim of the editor, evident, is to provide matter that will be read, and in this he appears to be very successful. At the same time instruction is imparted by methods that rob the path of education of its rugged rocks. We are pleased to see the *Locomotive Engineer* come so vigorously out of the second year of its existence, and hope that its growth in grace and prosperity may continue.

Personal.

Mr. D. M. Philbin has been appointed superintendent of the Duluth, South Shore & Atlantic.

Mr. Joseph Hickson, general manager of the Grand Trunk, has been knighted by the Queen of England.

Mr. E. V. Sedgwick has accepted the position of Master Mechanic on the Mexican National at San Luis Potosi, Mexico.

Mr. E. L. Dudley, vice-president and general manager of the St. Paul & Duluth road, was stricken by paralysis, and died Jan. 15.

Mr. A. J. Manderson has been appointed to succeed Mr. W. H. Burns, promoted, as superintendent of the Iowa division of the Union Pacific.

Mr. Frank A. Harrington has been appointed assistant superintendent of the Mohawk & Hudson division of the New York Central & Hudson River.

Mr. F. M. Leader has been appointed general manager of the Bloomsburg & Sullivan road, of which he has been superintendent since September, 1887.

Mr. J. M. Winslow, for some time Superintendent of Motive Power of the Mexican National, has gone into a private machine business in Tacoma, Wash.

The death is announced of Mr. William Stroudley, locomotive superintendent of the London, Brighton & South Coast Railway, and one of the ablest railway engineers in Europe.

Mr. W. P. Harris has been appointed superintendent of construction and general superintendent of the Charleston, Cincinnati & Chicago road. His headquarters will be at Johnson City, Tenn.

Mr. W. H. Burns, freight agent of the Union Pacific at Council Bluffs and Omaha, has been appointed assistant general superintendent of the same road, with headquarters at North Platte.

Mr. W. H. Holcomb, vice-president of the Union Pacific, has been elected to the same position on the Denver, Texas & Fort Worth, which road is to be operated as a division of the Union Pacific system.

It is reported that John S. Paterson, late superintendent of motive power of Big 4 at Cincinnati, has been appointed superintendent of motive power of C., H. V. & T., succeeding Mr. Ira Hutchins.

Mr. Jay Westinghouse, president of the Westinghouse Company, of Schenectady, N. Y., manufacturers of agricultural implements, and eldest brother of Mr. George Westinghouse, died Jan. 17.

Mr. Isaac H. McEwen, trainmaster of the Buffalo division of the Erie, has been appointed to succeed Mr. Edgar Van Etten, resigned, as superintendent of the Western division of the Rome, Watertown & Ogdensburg.

Mr. John C. Gault, for some years General Manager of the Cincinnati, New Orleans & Texas Pacific, has resigned. Mr. Gault has been 40 years in the railroad service, and has made an eminent success in numerous positions.

Mr. W. F. Kearney has been appointed general master mechanic of the Ohio, Indiana & Western, vice Mr. J. King, resigned. Mr. Kearney was for some years division master mechanic on the Chicago, Burlington & Quincy.

Mr. W. E. Corcoran, one of the best railroad journalists in the United States, has been out of newspapers for several months, but he has now returned to his old love, having accepted the position of railroad reporter with the Buffalo *Express*. The *Express* is fortunate in securing the services of such an able and well-posted writer.

The return of Mr. J. E. Child to the general managership of the New York, Ontario & Western after a brief but successful period as general manager of the Lake Shore & Michigan Southern, will be quite a pleasant surprise to his many friends. It is understood that he took charge Feb. 1, Mr. Burton to return to the Grand Trunk; at least it is so rumored.

On the occasion of his departure from the Mobile & Ohio, to take a position on the St. Louis, Arkansas & Texas, Mr. Z. J. Ferguson, master mechanic, was presented by the engineers and other employés of the former road with a handsome present. Mr. Ferguson rose from a workman to be master mechanic on the Mobile & Ohio, and he has many friends on the road who regret his quitting the employ of the company.

The New York Central branch of the railroad department of the Young Men's Christian Association of which Mr. G. A. Warburton is secretary, is doing a wonderfully successful educational work among the young railroad men of New York and the vicinity. Among the latest work performed for young men has been the organizing of drafting classes at the rooms of the various districts in New York City and at Weehawken.

Mr. W. G. Oakman has been elected first vice-president of the Richmond & Danville system, succeeding Mr. T. M. R. Talcott, resigned. His headquarters will be in New York City. Mr. Oakman rose from the ranks on the Delaware, Lackawanna & Western to the position of superintendent of the Utica division. He is a pleasant, genial man, and was extremely popular with high and low. While stationed at Utica he married, under somewhat romantic circumstances, the daughter of the late Senator Conkling.

The Bahia and the Habana railways of Havana were consolidated last year, and Mr. F. F. Tynan, an active member of the American Railway Master Mechanics' Association, was appointed superintendent of motive power and chief engineer of the company's steamers in the Bay of Havana. The name of the new company is Ferro Carriles Unidos de la Habana. Mr. Tynan writes us a pleasant letter, and warmly congratulates us on the interesting character of the NATIONAL CAR AND LOCOMOTIVE BUILDER.

Dr. Coleman Sellers, owing to protracted delicate health, retired two years ago from the firm of William Sellers & Co., of which he had long been an active member. Shortly afterward he was appointed lecturing professor of the Stevens' Institute of Hoboken, N. J., a position that calls for attendance only two or three times a year. Dr. Sellers has greatly regained his health lately, and like all men who have led an active life, he finds luxurious idleness irksome, so he has begun acting as consulting engineer. His eminent standing as an engineer, and socially, ought to recommend Dr. Sellers to those who require advice on engineering. His address is 3301 Baring Street, Philadelphia.

We are pleased to intimate to our readers that Prof. A. T. Woods of Champaign, Ill., who is contributing to our pages the very valuable articles on compound locomotives, is prepared to undertake work as consulting engineer in connection with the designing of compound locomotives. He states, in reply to inquiries from us, that he is prepared to examine proposed plans for converting old locomotives into compounds, and to report on proportions, value adjustments, etc., and to furnish designs in a limited number of cases. Master mechanics who contemplate making practical tests of the compound principle would do well to consult Professor Woods, for he is the best posted man in the country on this subject.

Mr. H. Tandy, who for the last three years has so efficiently handled the Motive Power and Car Department of the New York, Ontario & Western Railroad, has resigned to take the superintendency of the Brooks Locomotive Works. Mr. Tandy left this company's services as head of the designing department to enter the services of the Ontario, and it must be a source of considerable gratification to him to be thus recalled to fill this responsible position. Although every reasonable effort was made on the part of the railway officials with whom he has so strongly intrenched himself to retain him, the offer from the Brooks people was so generous that he could not well resist it. He takes with him the heartiest congratulations and best wishes of all who know him.

One of the most eloquent and touching testimonials to the worth of a departed friend that we have ever read is in the record of resolutions adopted at a meeting of Carnegie Brothers & Company respecting the death of Captain W. R. Jones, who was for years manager of the works, and was killed in an accident last year. The resolutions are printed in a beautiful "Memorial" that appears to show the hand of the head of the firm Mr. Andrew Carnegie. One of the articles reads: Resolved, That to us his employers and friends, who knew him intimately through many years of almost daily intercourse, there is still left in our grief, though he has gone, the precious privilege of meditating upon a combination of manly qualities, which constitute the real man, and which, united in him, gave forth that indefinable but rarest quality, character; a brave, just, honest, transparent soul; a stanch, loyal-hearted, generous friend was he whose loss we deeply mourn.

Horatio Allen, one of the leading pioneers of railroad building, died at his home near South Orange, N. J., on January 1, at the age of 88 years. Mr. Allen took a prominent place in the construction and operating of American railroads during the first twelve years of their history, but what will always keep his name familiar to students of railroad development is the fact that he was the first man to run a locomotive on the American Continent. He was sent to England in 1828 to get a locomotive to operate a piece of railroad then building in Pennsylvania for the Delaware & Hudson Canal Co. He brought the "Stourbridge Lion" to New York in May of the following year, and shortly afterward made a trial trip with the engine at Honesdale, Pa. It was found to be too heavy for the track; but the notable trial trip will never be forgotten as long as railroads are the principal arteries of intercommunication.

Mr. J. H. F. Wiers, of Drake & Wiers, car-roof makers, died lest month at his home in Cleveland. The cause of his demise is given as pneumonia. Mr. Wiers was well known in railroad circles, having graduated from the service some years since to engage in the manufacture of car roofing, being the junior member of the firm of Drake & Wiers, of Cleveland. Mr. Wiers was formerly master car builder of the New York, Pennsylvania & Ohio road, and later superintendent of the Paige Car Wheel Works, of Cleveland. Leaving that position, he became purchasing agent of the Toledo, St. Louis & Kansas City road, which he held until forming his present partnership. Mr. Wiers was the first manager of the great Pullman Works at Pullman, Ill., occupying that position when the works and town were under construction. His death will cause widespread grief, as his friendships were numerous and his manners genial. He was 59 years old.

There has been a freight car "famine" in Colorado for some time and the shippers who suffer from the delay in getting the cars required are urging the railroad companies to increase the demurrage charges as a means of preventing the much-needed cars from being used as storage warehouses. So far the other side has not been heard from, but it may be safely affirmed that receivers of cars will make a vigorous fight against any infringement of what usage has made their right to hold their freight in the cars as long as they pay the ordinary demurrage.

Locomotive Builders Wanted.

The minister for railways in New South Wales is advertising for a firm of locomotive builders to establish building shops in that colony under government patronage and support. The government guarantees to give the concern 100 new locomotives to build within the next three years, provided the price does not materially exceed the price of similar engines built by first-class English firms and delivered in Sydney. Locomotive building matters appear to be a little mixed in New South Wales. A few years ago the government built and equipped extensive works at a cost of $2,800,000, for the purpose of building and repairing the rolling stock belonging to the railways which are under government control. A free trade government came into power shortly afterward, and the large shops were closed up under the policy that rolling stock should be bought from the lowest bidder, if that bidder did not happen to be an American firm. For some reason which we do not clearly understand this policy has been modified to encourage native industries, with the result that the government invites locomotive builders to put up works. To a man at a distance it would appear to be the best pian to hand over the shops already built to some private concern, but it may be that the building of new shops is an industry that needs artificial encouragement. The government of New South Wales appears to be very liberal toward those who do work in the colony. A contract for the building of 50 locomotives was some time ago let to a colonial firm, and about $2,000 per engine was to be paid above the cost of the same machines sent from England or America. A curious part about the business was that the parts of the engines were manufactured in England, and all the local builders did was to set them up. We should strongly advise some of our moribund locomotive builders to move their works to Sydney. There they would find encouragement and paying prices that would call for no modern methods of manufacture.

Annual Meeting of Central Railroad Club.

The Central Railroad Club held its annual meeting at the Iroquois Hotel, Buffalo, Jan. 22. There was a session for general business and the election of officers, after which the meeting resolved itself into the dining-room and entered into a very hearty discussion of a luxurious dinner. President Chamberlain occupied the chair through both exercises, and proved himself as much at home in encouraging the members and friends to eat, drink and be merry as he was in inveigling timid members to rise in meeting and tell what they knew about interchange of cars and other alluring subjects.

An effort was made to arrange for holding the meetings of the club every month, but after the matter was discussed it was decided that they should be held on the third Wednesday of the months of January, March, May, September and November.

There was a short discussion on seam checks in cast-iron wheels, and conclusions were reached that will be reported to the Committee of the Master Car Builders' Association having charge of the revision of the rules of interchange of cars. Several other interchange rules were discussed, following a report made by Messrs. J. D. McIlwain, Peter Smith, James Macbeth and James Schrimpton.

Messrs. A. Dolbeer, Macbeth and Miller submitted reports on Locomotive Construction. They related principally to the relative fuel consumption of engines with diamond stack and others with the open stack, and also with and without the brick arch.

The officers elected for the ensuing year are:

President, Eugene Chamberlain; vice-president, A. C. Robson; secretary and treasurer, F. B. Griffith; executive committee, T. A. Bissell, J. D. McIlwain, P. H. Griffin, C. A. Gould, Peter Smith, James Macbeth, C. E. Rood.

On motion, W. E. Corcoran, of the *Express*, and Harry D Vought, of the *Courier*, were elected assistant secretaries.

A monument to perpetuate the Camden & Amboy Railroad, one of the first constructed in this country, is to be erected near the High Bridge, a mile north of Bordentown. The massive blocks of stone, the original rails, spikes and plates used in 1831, on the occasion of the first trip of the locomotive "John Bull" from Bordentown to High Bridge, in the presence of the New Jersey Legislature, are all carefully preserved, and will form a part of the monument.

The second largest mill on Puget Sound is located in Tacoma and is owned by the Tacoma Mill Company, the stock of which is almost entirely owned by Mr. Charles Hanson, the founder, and his family. It was the first business enterprise on Commencement Bay, and is still the largest and most important after the Northern Pacific railroad. Nominally, the capacity of the mill is 250,000 feet, but the largest cut ever made on Puget Sound, over 465,000 feet in ten hours, was made in this mill in July of last year.

Mahogany as a material for inside finish of cars continues to hold its own to the exclusion of nearly all other woods. Quartered oak had a short run for the cheaper type of cars, but it is now little in demand. At the principal passenger car-building shops one occasionally sees a car finished in our native ornamental woods, but mahogany is called for in nearly all cases. A specially valuable feature about this wood for inside finish is its beautiful wearing qualities. Age instead of tarnishing gives it a fine deep mellow appearance, so that the oldest car when newly upholstered and cleaned up looks as well, if not better, than when it first left the shop.

The St. Charles Car Company have built the entire passenger car equipment required for the standard gauge of the Denver & Rio Grande Western. The cars are considered about the finest built last year. They are finished in mahogany after extremely handsome designs, each car being upholstered and finished in different styles. The cars are carried on four-wheel trucks with Paige 33-inch wheels, and they are equipped with every improvement regarded as being necessary to contribute to the comfort or safety of passengers. They have the Westinghouse quick-acting valves and air signals, they are heated by steam from the locomotive, and lighted by the Pintsch system. They have the Johnson car seat with improved roll head rest, and they have large, double, plate glass windows. The mountaineers of that region are talking very uppishly about the Denver & Rio Grande Western's new cars.

The New York Central Railroad has placed an order with the Schenectady Locomotive Works for twelve big passenger engines of unusual capacity and power, and they are intended to do some first-class service on the limited trains. The engines now in use cannot pull a train of more than six Wagner cars without sometimes dropping behind time under unfavorable circumstances. The new locomotives will easily taken seven or eight cars, and nine or ten when necessary, and it is expected that they will be able to materially increase the speed of these heavy trains. The cylinders are 19 × 24 inches, the drivers are 70 inches diameter and the two pairs will carry a weight of 85,000 pounds, the heaviest weight on drivers that ever has been tried. To carry this with safety and to give an ample bearing surface the journals are 8½ × 10½ inches. The boiler is 58 inches diameter at smallest ring, and the firebox, which is set above the frame, is eight feet long and dips down in front to give increased depth of fire. The track in some of the bridges and tunnels has to be depressed three inches to permit these engines to pass safely through.

A great meeting of a "grand council" of railroad trainmen was held in Boston last month to consider questions affecting their interests. The first question discussed and acted on was the necessity of safety drawbars for freight cars. Reports were submitted from nearly every large railroad system in the country. The reports stated that 20,148 men annually lost some of their limbs, and that 2,070 lost their lives because the railroad corporations continued to use the old time link and pin on freight cars. It was claimed by the council that brakemen stood but one chance in 47 of dying a natural death. The committee appointed at the last meeting of the council to investigate the various safety couplers for freight cars reported in favor of the Safford drawbar. The council accepted the report, and decided to recommend to railroad companies the advisibility of using the drawbar favored by the committee. Many letters, from President Harrison, members of Congress and other public officials, pledging support of any measure that would tend to bring about the adoption of safety appliances on railroads, were read. On receipt of these letters the council decided to present a bill to Congress and to the State Legislature asking that the railroad companies be compelled to put safety drawbars on all cars. The need of having a safety railing placed on the tops of cars to prevent men from rolling off of the car while it was in motion was discussed at length. Nearly every delegate cited instances where lives had been lost because cars at the present time was not provided with this simple and inexpensive safeguard. The council decided to do all in it power to have all cars provided with safety railings.

The driving axle boxes of the heavy locomotives recently ordered by the New York Central from the Schenectady Locomotive Works have been specified to be made of phosphor bronze. We recently examined one of the boxes as it came out of the sand, and it weighed 550 pounds. It was expected that 150 pounds of metal would be taken off in finishing each box.

Contracts for 1,200 gondola cars for the Pennsylvania lines have been awarded by Edward B. Wall, superintendent of motive power of the southwest system, as follows: Erie Car Works, Erie, Pa., 500; United States Rolling Stock Company, Hegewish, Ill., 500; Lafayette Car Works, Lima, O., 200. The cars are for as early delivery as possible, and will probably be received by May 15.

Master Car Builder McGee, of the Houston & Texas Central road, is engaged in an earnest effort for the protection of brakemen while coupling freight cars. He is now putting in six improved styles of freight draw-heads for trial, with a view to selecting that which proves to be the best and safest after having been well tested. It will be a question decided entirely on its merit and upon the ideas of the brakemen. they being the men who are most deeply interested in getting the safest.

Mr. John T. Heffernan, of Dunkirk, N. Y., has been granted a patent on an improvement in locomotive spring gear. It is thus described in a letter to us from the inventor: Instead of an equalizer I use a spring to make connections between the springs on the wheels, and again both forward and back are springs running across from one side to the other, thus making a perfect spring gear, as the strain from one wheel is transmitted all around. On the hangers, and a certain distance above and below the frame, are placed pins, arranged in such a manner that should a spring break the pins engage with the frame, thus preventing the relaxation of the tension in the remaining springs. I have noticed, during my connection with low work, that springs break, as a rule on what we call the "dead end." The same thing has probably come under your notice. You take an easy riding engine, and it is easier on the machinery in every way than a hard riding one. This gear lets the spring work even on both sides, and, therefore, it won't throw any undue strain on the springs. Some of the leading master mechanics of the West have pronounced it a good device.

"What People Say About Us," is the title of an illustrated pamphlet published by the Buffalo Forge Company. It contains useful information about fans and blowers.

The Union Switch and Signal Company, Swissvale, Pa., have made an important improvement on the Westinghouse Friction Buffer, which makes it double-acting, so that it is operative under either a pull or push. This buffer is proving itself a great protection to drawbar gear, and it is shown to effect material saving of repairs wherever it is used.

Messrs. F. W. Coolbaugh, S. W. McMunn and L. R. Pomeroy have entered into partnership, with offices at 45 Broadway, New York, and they have been appointed special agents for Carnegie, Phipps & Co. They are also general sales agents for the Boies steel wheel and general Eastern agents for the Frost dry carburetter system of lighting. The gentlemen who constitute the new firm are all highly popular and able men, and their combination is a particularly strong one.

The Jackson & Sharp Company, of Wilmington, Del. have recently built and shipped 40 passenger, sleeper and combination cars to Brazil for one of the government rail ways there.

Betts Machine Company, Wilmington, Del., have just shipped a large quantity of machinery, consisting of lathes, horizontal and radial drills, to the new shops of the Pennsylvania Railroad Company at Altoona, Pa.

The Boyden Power Brake Company, of Baltimore, Md., has been reorganized under the name of the Boyden Brake Company, with a capital stock of $2,500,000. They report that they are meeting with good success, having their brake on quite a number of locomotives.

The Consolidated Car Heating Company have collected and put in a circular a number of the latest railroad accidents where loss of life happened through fires caused by stoves, and notable cases of prevention through the cars being heated by steam. The circular makes interesting reading. If it could be put in the hands of all travelers, they would be apt to find out and travel by the lines where steam heat was used.

Mr. F. W. Dean, Mechanical Engineer, Associate Member American Railway Master Mechanics' Association, Member American Society of Mechanical Engineers, 27 School Street, Boston, desires to inform superintendents of motive power and master mechanics of railways that he is prepared to furnish designs for compound locomotives and high-pressure boilers adapted to any kind of service, from which a saving over the ordinary forms of from 15 to 25 per cent. of fuel may be expected. Designs for converting existing locomotives into compounds will be furnished.

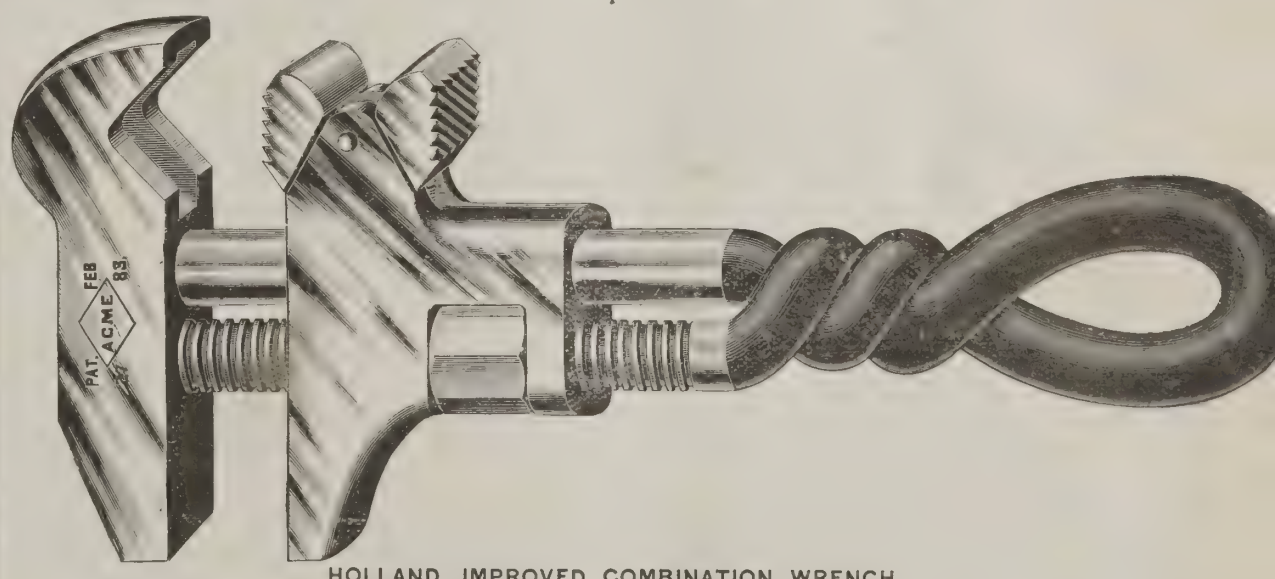
The Pennsylvania Steel Company write under date of Jan. 10: "We have for several years made extensive use of 'R. Mushet's special steel' for planing steel rails for switches and frogs, and find no steel equal to it for that purpose. In fact it is simply indispensable in conducting that branch of our business."

The above is certainly a very hearty indorsement of the "Mushet's" steel, the sales of which in this country we are informed are steadily increasing, notwithstanding it has had many "imitators" to contend with. It is handled in this country by B. M. Jones & Co., Oliver street, Boston.

The Joseph Dixon Crucible Co., Jersey City, N. J., closes 1889 with satisfaction. The company say: Our business has been larger in every branch than in 1888. Our chief new departure in 1889 has been in the large increase of equipment at our Graphite mines at Ticonderoga. We have laid the lines there for a five years' continuous run—tearing down and rebuilding almost every thing much larger than before.

The specially large increase in the sales of Graphite Paint, Graphite Grease, Graphite Oils and other Graphite lubricants, has pushed us to this. The sales of our standard and well-known Dixon Stove Polish, Dixon Crucibles, and Dixon "American Graphite" Pencils have also largely increased.

The Scarritt Furniture Company, of St. Louis, makers of the popular seats and chairs, held their annual election on the 21st: President, H. H. Curtis; vice-president, S. G. Scarritt; treasurer, Geo. T. Parker; secretary, J. H. Holman, all of St. Louis. This company have just taken the order for furnishing the seats for the "Southwestern Limited" trains of the "Big Four" (C., C., C. & St. Louis). They are to be very handsome quarter sawed oak frames of special design, in rich colored plushes. The Scarritt car seats of the new patterns are very popular. The Chicago & Alton, always "up" in improved equipment, have just received the last of their recent order for seats for four cars, and have placed new orders for seats for additional cars. The Texas & Pacific have just put on a new lot of the Scarritt car seats in rich upholstery and cherry frames.

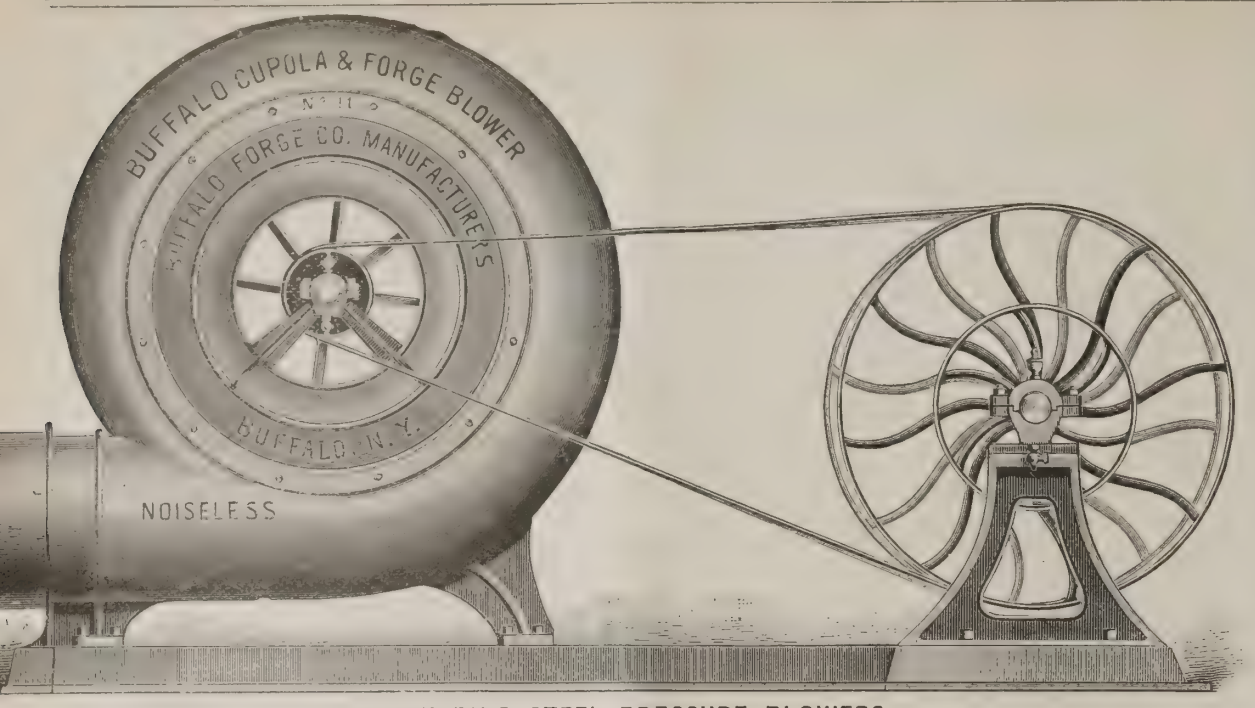


HOLLAND IMPROVED COMBINATION WRENCH.

Annexed engraving shows the Holland improved Acme combination pipe bolt and nut wrench, which contains all the well known features of the Acme steel wrench. The Holland improvements consist in the peculiarly shaped head, which permits a very tight grip on the pipe without slipping or crushing it, but principally in the reversible double face hardened tool steel grip jaw. This grip jaw is made of the best quality tool steel, and has two faces with teeth. After the teeth on one side have been worn away the other side can be used, thus making the one grip jaw an equivalent to two. The pin which holds the grip jaw in place to prevent it from falling out can easily be removed, and the jaw reversed in a moment's time.

The construction of the lower side is such that the pin holding the grip jaw receives absolutely none of the strain, and the entire strain comes on to the shoulders of the grip-jaw carriers, which are shaped in such a manner as to give them the greatest possible strength. The teeth on the grip jaw, after they are worn dull, can easily be resharpened and tempered a number of times, thus making the tool the most serviceable on the market. Separate grip jaws at small cost, to take the place of worn ones, are also furnished.

The capacity of these wrenches is large and the strength very great. They are manufactured in four sizes, 5″, 10″, 12″ and 15′. The 5″ combination wrench is especially adapted for a bicycle-spoke wrench, and for work on small wire or gas burners. They are made by the Capitol Manufacturing Co., Chicago.



BUFFALO STEEL PRESSURE BLOWERS.

The annexed engraving illustrates a Buffalo steel pressure blower on a recently perfected pattern of adjustable bed with countershaft, designed and constructed with special reference to high-pressure duty, such as supplying blast for cupola furnaces, forge fires and sand-blast machines, also for forcing air long distances.

By means of a tightening screw, the blower may be moved upon the bed while running at full speed, taking up any slack, giving both belts a uniform tension, which is regulated at the will of the operator, and is a very important point in preventing the inconvenience and loss incurred by a stoppage during heat when blowers are used for cupola purposes.

A decided saving by use of the bed is gained in the wear and tear of bolts, for a simple turn or two of the nut on end of adjusting screw and re-tightening of the holding down bolts, takes but a moment or two, and accomplishes the same end as relacing of the belts, which usually is put off until the belt will run no longer on account of so much slack.

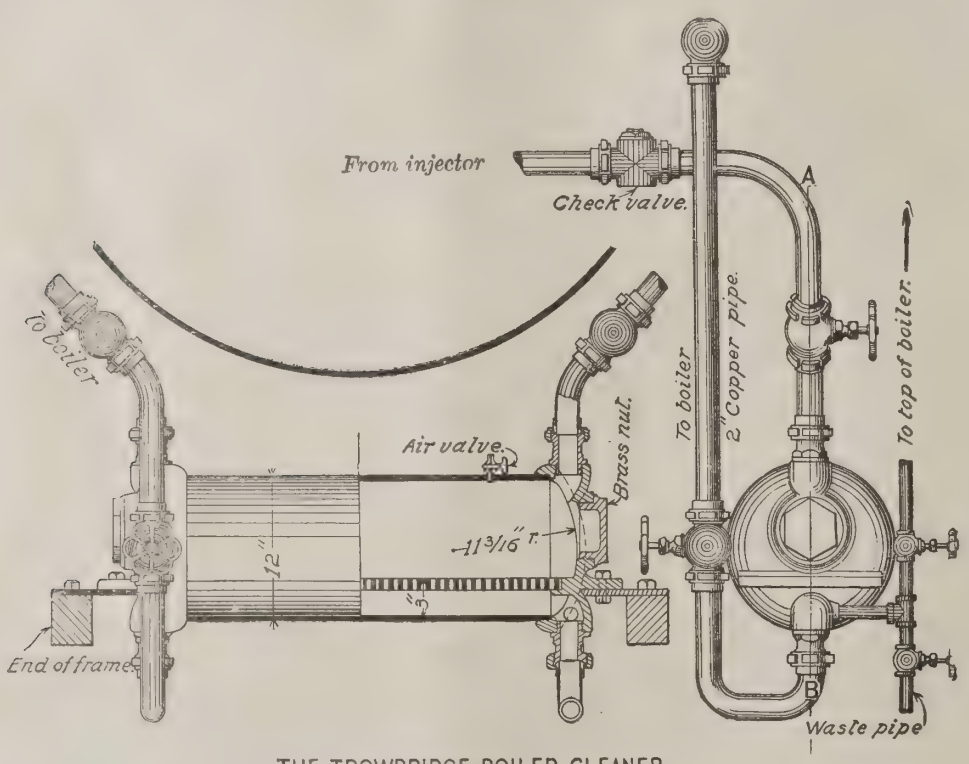
Special attention should be directed to pressure blower belts on account of the high rate of speed at which they must necessarily run, and absolutely perfect alignment of the countershaft with the blower is essential in order to secure smooth running, even tracking, and to avoid undue wear of belts by slipping.

A telescopic mouthpiece is employed in order that the blast piping may not be disarranged in moving the blower on the bed, while sufficient length is afforded to the countershaft, so that tight and loose pulleys can be used for the main driving belt. A self-oiling device fitted to the countershaft enables it to be run at high speeds for long stretches with perfect immunity from heating or cutting.

A distinguishing feature of these blowers is the solid case, the peripheral portion of the shell being cast in one solid piece, dispensing with the objectionable "putty joint."

Thus being practically one piece, under the hardest service the bearings must always be in perfect alignment vertically and laterally with the rest of the machine, thus making it superior in items of durability, smooth running and economy of power to any other journal bearing in use.

The journals are long and heavy, in the standard ratio of length to diameter of 6 to 1, with cap bearings secured by bolts screwed in lower half of bearing, held in place by lock nuts. It is impossible for bearing to rattle loose and any wear can be at once taken up. Made by the Buffalo Forge Co., Buffalo, N. Y.



THE TROWBRIDGE BOILER CLEANER.

The annexed engraving illustrates the working of the Trowbridge Boiler Cleaner, an apparatus used for feeding into the boiler a supply of potatoes which appears to disintegrate all kinds of incrustation and prevent the formation of scale on the heating surfaces. Mr. John Hickey, master mechanic of the Milwaukee, Lake Shore & Western, has applied the boiler cleaner to several of his locomotives, and it is reported to produce good results. The virtue of potatoes as a preventer of scale have been long known, and the material has been considerably used with stationary boilers, but hitherto it has been excluded from locomotives through the difficulties of applying it. The Trowbridge apparatus overcomes this difficulty and enables those in charge to apply the remedy at any time when water is fed to the boiler.

The manner is which this device is operated is about as follows: Having emptied the cleaner, the hand-hole plate is removed and several pounds of potatoes are placed within the cleaner. After closing the drum steam is admitted, and the potatoes thoroughly softened, after which the feed water is admitted, and the potatoes are driven through into the boiler In operating this device, instructions are given to blow off the boiler a little every morning, at least enough to lower the water in the gauge glass an inch. The action of this cleaner is slow, but no detrimental effect is seen on the tubes or sheets. This apparatus is made by Messrs. H. T. Sackett & Co., Fond du Lac, Wis.

The Magnolia Anti-Friction Metal Company has had a beautiful waltz written for it in Europe, and dedicated to it, entitled "Magnolia Valse." Any one who desires a copy of the waltz may obtain it by writing and inclosing three cents for postage.

The Detrick & Harvey Machine Company of Baltimore City, a corporation, succeeds the firm of Detrick & Harvey, and with increased facilities will continue the manufacture of the open-side iron planers, machine tools, special and general machinery.

The Frost Dry Carburetter system of lighting has so pleased the patrons of the New York, Susquehanna & Western in its trial on the Paterson train that General Superintendent McKelvey has adopted it as the standard, ordering it on several other trains, also including it in specifications for six new coaches.

The American Railway Equipment Company, 15 Cortlandt street, New York, and 616 Phœnix Building, Chicago, have superior facilities for manufacturing and securing the adoption of railway improvements of genuine worth. They solicit correspondence from parties having appliances of merit that they want introduced.

We have received from the Phosphor Bronze Smelting Company, Philadelphia, a new catalogue and price list for this year. The catalogue gives interesting information respecting the uses for which phosphor bronze is best adapted.

The E. Horton & Son Co., manufacturers of the well-known Horton chuck, have issued a neat illustrated catalogue which is chuck full of all kinds of chucks. Each and every one of our readers who use chucks ought to send for a copy of the catalogue and it will make the man chuckle who writes: Of all the Chucks I ever saw chuck, I never saw a Chuck chuck as that Chuck chucks, is what a chuckle-headed Chuck maker said, when his chuck was chuckingly chucked out of the shop into a chuck hole to make room for a Horton Chuck that was chucked in for the chucking lathe. Then the Horton Chuck man chuckled, and chucked in more chucks.

The Westinghouse Machine Company's engines continue to make progress into favor, not only in the United States but all over the world. The company's report for last month notes the sales of engines in England, Sweden and Demerara. The Metropolitan Electric Light Company of London, England, equipped one of their stations with Westinghouse compound engines, and the event was considered of so much interest that on the day the engines were started Mr. Robert Lincoln, American Minister, and other distinguished Americans attended and watched the working of the electric plant. A new compound of 250 H. P. was lately put into the Baldwin Locomotive Works to replace an engine of the ordinary type, and the change was made in eight and a half hours.

Our Directory.

Our directory has been thoroughly revised since last month, and changes made that are too numerous to mention. We send out notices periodically asking railroad officers to make required corrections on our directory, and we are highly gratified to say that we never before received so many replies as were given to our last circulars. We wish cordially to thank the railroad managers and others who have so kindly lent us their assistance in making the directory correct.

The Only One.

The Chicago, Milwaukee & St. Paul Railway is the only line running solid vestibuled, electric lighted and steam heated trains between Chicago, Milwaukee, St. Paul and Minneapolis.

The Chicago, Milwaukee & St. Paul Railway is the only line running solid vestibuled electric lighted and steam heated trains between Chicago, Council Bluffs and Omaha.

The berth reading lamp feature in the Pullman sleeping cars run on these lines is patented, and cannot be used by any other railway company. It is the great improvement of the age. Try it and be convinced.

For further particulars apply to the nearest coupon ticket agent, or address A. V. H. Carpenter, General Passenger Agent, Milwaukee, Wis.

STATE OF NEW YORK, COUNTY OF NEW YORK. } s.s.:

We, R. H. Plass and J. Viosca, Trustees of the Standard Corporation of New York, and a majority thereof, and the said R. H. Plass being the president of said company, do hereby certify and declare:

That the capital stock of said company is five hundred thousand dollars.

That the entire capital stock of said company was issued for the purchase and payment of property necessary for the company's business.

That two hundred thousand dollars, in par value, of the capital stock of said company was reconveyed to the company for treasury stock or working capital.

That about one hundred thousand dollars in par value of said treasury stock has been sold for necessary property, cash or its equivalent.

That the balance of the treasury stock, about one hundred thousand dollars, in par value, remains in treasury of company.

That the existing debts of said company amount, as near as can be ascertained, to the sum of nine hundred dollars.....

Witness our hands this twentieth day of January, 1890.

R. H. PLASS, President.
R. H. PLASS, J. VIOSCA, } Trustees.

STATE OF NEW YORK, COUNTY OF NEW YORK. } s.s.:

R. H. Plass, being duly sworn, says: That he is the president of said Standard Corporation of New York, and that the foregoing annual report is true to the best of his knowledge information and belief. R. H. PLASS.

Sworn to before me this 20th day of January, 1890.

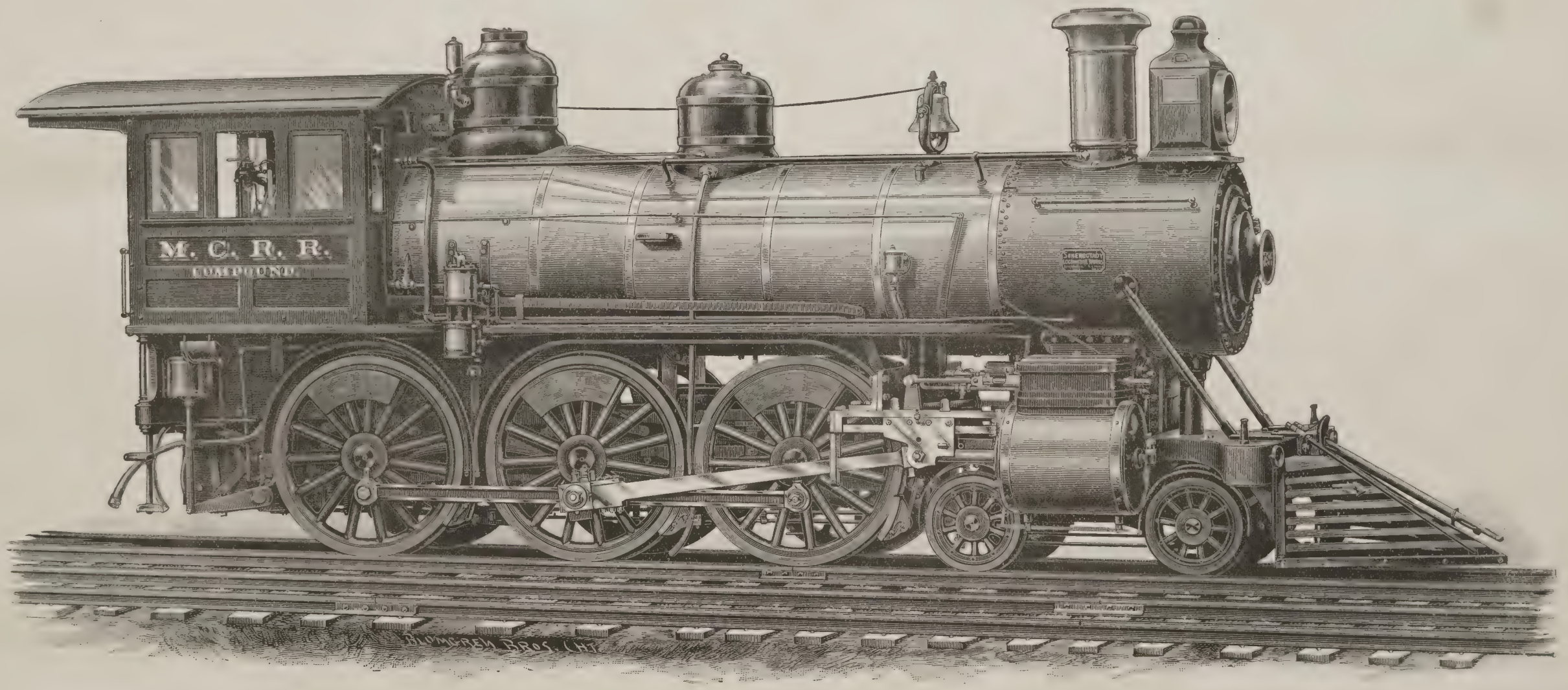
F. E. BARNARD,

Notary Public Kings County Court. Filed in New York County.

Employment.

WANTED.—Position as master car painter by a thoroughly capable man who has proven himself an able executive officer and a first-class artisan. Address E. W. Selkirk, 208 East Eagle street, Buffalo.

WANTED.—A situation as foreman in car department in a railroad shop. Has had twenty-six years' experience, twelve years as general foreman, and has good references. Address T. G., P. O. Box 260, Cambridge, O.



SCHENECTADY COMPOUND LOCOMOTIVE,

BUILT FOR THE MICHIGAN CENTRAL RAILROAD COMPANY.

NATIONAL CAR AND LOCOMOTIVE BUILDER

MARCH, 1890.

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The Illinois Central has just given out an order for 20 locomotives.

The Wisconsin Central have ordered 10 new eight-wheel passenger locomotives from the Brooks Locomotive Works.

The Boston & Maine are reported to be in the market for 20 locomotives, the New York Central for 50 locomotives, and the East Tennessee, Virginia & Georgia for 28 locomotives and 1,500 freight cars.

The Central of Georgia has just received 13 of the locomotives ordered from the Dickson Locomotive Works. Twenty more engines belonging to the same order will be delivered early this month.

The Pennsylvania Railroad is applying the Dean guide to some locomotives under construction. We are also informed that the New York, Providence & Boston Company have specified Dean guides for some engines to be built for them by the Rhode Island Locomotive Works.

A very important piece of news in regard to car couplers is the ordering by the Philadelphia & Reading of 8,000 of the Van Dorston cushioned coupler. This coupler, as most of our readers are aware, is of the Master Car Builders' standard type, with certain valuable features peculiar to itself.

The secretary of the Railway Master Mechanics' Association has sent out lately two circulars from committees of investigation. One is from the committee on "relative value of steel and iron axles," of which Mr. John Mackenzie is chairman. The other is from the committee on "efficiency of the link as compared with other valve motions," of which Mr. James M. Boon is chairman. Both circulars are likely to bring out all the information that can be obtained on the subjects.

Master Car Builder Ballentine, of the Seaboard & Roanoke, is making a record for himself in the amount and class of freight work he is turning out in his new shops. Some 600 cars, box, gondolas and flats have been built for this line and the Atlanta Extension, for many of which he was the successful competitor against outside contractors. The workmanship, quality of materials used and the simple yet ingenious "kinks," worked in with a view first to strengthen and to cheapen cost of construction, will compare more than favorably with any we have ever seen.

The Chamber of Commerce of Atlanta, Ga., have been considering the practicability of establishing car building works in that city, and a committee was appointed some time ago to report on the scheme. This committee have recommended that a committee be appointed by the Chamber of Commerce to procure a charter for said works, with a capital of $250,000, with authority to increase the same from time to time to an amount not to exceed $1,000,000, and that said company be authorized to organize and commence business when $100,000 of the capital stock is subscribed.

It is amazing, the vitality possessed by the four-wheel coal jimmey, after it is ordered off a road. The Delaware, Lackawanna & Western expected to be rid of these cars years ago, for none have been built in ten years, but they hold on as if they would last for a thousand years, say the trainmen, who hate them. The Philadelphia & Reading now announces that hereafter four-wheeled coal cars will be run only between the mines and Port Richmond wharves; also, that all such coal cars must be run in the rear of all trains. A great many wrecks have been traceable to these small cars, and this movement is intended to prevent their frequent occurrence. It will be remembered that the road has recently destroyed a large number of this class of cars.

Perhaps one of the best equipped short stretches of road and the most thoroughly wide awake, businesslike managements in the South, is the Seaboard & Roanoke road, 80 miles long, running from Portsmouth, Va., to Weldon, N. C. Track alignment is almost perfect, broken joints are laid, all safety switches, station semaphores, soft coal-burning engines, extension fronts, most modern coaches, oak interiors, large plate windows, steel tired wheels, air whistle, etc. This run of 80 miles, with 13 stops, is made in 2 hours and 40 minutes, all of which indicates marked progress conducive to the traveler's comfort, and reflects most creditably upon the management of this line. May this same spirit of enterprise spread North as well as South.

At the last meeting of the Western Railway Club a committee appointed to consider the publication of report of the proceedings made recommendations. They reported in favor of withholding a report of the proceedings of the meetings until they were published by the club. The effect of this arrangement will be that the railroad press will not obtain reports until they are hoary with age, and few of them will care to publish such matter. The change will not prove conducive to the prosperity of the Western Railway Club. Two correspondents, whose letters will be found on another page, take very strong ground against curtailing the reports of railroad clubs. We must admit that our sympathies are entirely with the sentiments of our correspondents.

The Richmond Locomotive Works bid fair to be a strong competitor for the locomotive business of its surrounding section, and ultimately for the business of the country at large. They are certainly admirably located so far as their relationship or contiguity to the different lines of road for deliveries to the south, west and southwest may benefit them. These same advantages obtain in procuring materials such as they must go outside for. Their plant is rapidly growing and is certainly ably managed. The most modern tools, heavy hydraulic system, all indicate a looking ahead and means success. It's a question whether any better class of work can be found anywhere than the recent engines turned out by this company for the Richmond & Danville system.

The various committees appointed to perform work in connection with the investigation of the best metal for brake shoes are all carrying on their investigations with zeal and energy. Unless it was in the case of the investigations into the best form of brake for freight cars, we do not remember having met the members of any committee that were more enthusiastic about the work they were engaged on. Most of the work going on at present is in the form of shop tests, but these will soon be followed by practical tests in train service. We are informed that the officers of the Chicago, Rock Island & Pacific Railway have granted the use of their rolling stock and tracks near Chicago for the carrying out of the practical service tests. The portion of track where the tests will take place is admirably adapted for the purpose, it is straignt and level and is not crowded with traffic.

The Canadian Pacific Railway has had seven first-class coaches built to run in connection with the "Soo" equipment in the through trains between St. Paul and the East. These coaches are very handsome, and well built and finished, without any attempt at useless ornamentation. Each has seating capacity for 56 passengers, and the seats in the body of the car are of a modern pattern, high-backed and comfortable. At either end of the coach is a vestibuled smoking room, with russet leather covered seats for six persons. Between this room and the body of the coach is, in one end, the ladies' toilet room on one side, and the Baker Fire Proof Heater on the other; in the corresponding space in the opposite end is the gentlemen's closet, and on the other side of the car a lavatory. The aisles are carpeted, except in the smoking rooms, where the floors are covered with linoleum. All the inside finish, except the maple headlinings, is of oak, and the trimmings are Persian brass. The windows have, instead of sliding blinds, curtains. The trucks are four-wheeled, and the wheels Krupp steel tired.

At one time electric brakes were regarded with a good deal of favor, and considerable expectations were formed as to their capabilities. The transport of energy by electricity is so rapid, and the conductors are so light and easily handled, that it seemed as if the quick action, which is the essential feature of a good brake, could be very easily secured by electrical means. So far these expectations have not been realized, and the matter has dropped out of public attention. Inventors, however, have still continued at the subject, and some advance has been made. The progress of the last four years has been tabulated by Messrs. E. Sartiaux and L. Weissenbruch in a paper read before the late Railway Congress in Paris. It cannot be said that the paper affords much food for the hope that electrical brakes will come into vogue in the near future. Both the automatic air and vacuum brakes are so simple and efficient that there is little room left for the introduction of a new variety, unless it greatly exceeds them both in its braking power and also in economy of first cost. It would be greatly to be deplored if the present confusion caused by the multiplication of types of brakes were to be further aggravated; nothing but the most important advantages would justify such a proceeding.—*Engineering.*

The men who succeed in business in this day are not ordinary men. In fact, no ordinary man can succeed; the time has gone by for this. General knowledge is more comprehensive and universal than at any period of human history; the masses of men are better educated, and if not educated, they are better informed by reading and observation. So it is that business men know more, have a broader knowledge and intelligence, and are, consequently, shrewder and more enterprising. Compared with the business men of any former period, the merchants of to-day are far from ordinary men in their field of effort in life. And each day is making the field wider, and increasing the number of the necessary qualifications for success in it.

The mileage paid for different classes of cars, and for the same class of cars, says the Interstate Commissioners' report, is not uniform by different companies, nor by the same companies, except for ordinary freight cars exchanged between companies in the course of transportation. The rates allowed for car mileage were shown to be as follows: For ordinary freight cars, a uniform rate of three-fourths of a cent a mile; for Pullman palace cars, 3 cents a mile; for Pullman palace tourist sleepers, 1 cent a mile; for ordinary passenger cars exchanged with other companies, 3 cents a mile; for baggage, mail and express cars exchanged with other companies, 1½ cents a mile by some roads and 3 cents a mile by others; for refrigerator cars used for carrying dressed beef, 1 cent a mile in some cases and in other cases three-fourths of a cent a mile; for furniture cars, oil-tank cars, palace live stock cars and other cars owned by private individuals and companies, three-fourths of a cent a mile. Some companies pay mileage on tank cars both loaded and empty, and some only when loaded. For palace horse cars no mileage is allowed on some roads, shippers in such cars paying for the car. Since May 1, 1889, the roads running east and southeast of Chicago, with the exception of one company, have allowed three-fourths of a cent a mile for refrigerator cars. The one road referred to allows 1 cent a mile.

Steel Car Shops.

The American Fire-Proof Steel Car Co. which built some time ago a steel postal car in the shops of the Louisville, New Albany & Chicago Railway at New Albany, are about to erect large shops near Chicago for the building of steel passenger cars. Curiously enough, a leading promoter of this enterprise is Mr. T. W. Harvey, a large lumber merchant of Chicago, after whom the place will be named where the works will be erected.

Plans have already been completed for a large plant and allowances made for doubling or trebling its size. The first buildings to be put up will be for the building of freight, mail, baggage and express cars. The erecting shop will be 450 ft. long and wide enough for five tracks, which will extend the whole length of this building and through the paint shop, which is in line with the erecting shop. The paint shop is to be 350 ft. long, and will be separated from the erecting shop by an interval of about 15 ft. The erection of cars will begin at one end of the erecting shop, and from that point the cars will move forward, step by step, until they receive the last touches in the further end of the paint shop.

The machine shop will be located near the upper end of the erecting shop, and adjacent to it will be placed the blacksmith shop and foundry, so that all materials will be handled at a minimum cost. These last three buildings will be of sufficient size to do the required amount of work even if the erecting shop capacity should be increased by additional buildings

A Fashionable Car.

We understand that President Ingalls, of the Big Four, has expressed his thanks to the Wagner Car Company for the fine taste and care their officers displayed in the construction of a private car which was lately built for him at the Buffalo shops. The car is in the outside of the same general dimensions as the Pullman No. 5, and is carried on six wheel trucks with 36-inch Paige wheels. The interior is arranged with an observation room at each end, and a passage between them through which trainmen may pass without seeing inside the private rooms. One of the observation rooms is used as a dining-room, and adjoining it is the kitchen, a very compact room, but fitted with every necessity for carrying on high culinary art. President Ingalls' private room occupies a large portion of the middle of the car, and is arranged like an artistic parlor, with an antique carved mantlepiece with a hearth beneath, where a gas illumined log carries on the delusion that the occupant is enjoying home comfort. Sleeping accommodation is provided in this room for four persons. A bath room and lavatory adjoins the main parlor, and flanking it are two state-rooms with berths for two persons in each. The interior of the car is finished in English oak, cherry and black walnut. The floors are of finely selected parti-colored woods, and are covered with heavy Turkish rugs. The upholstering is electric blue embossed plush, and the windows are covered with raw silk curtains. The Wagner people have good reason to be proud of this car.

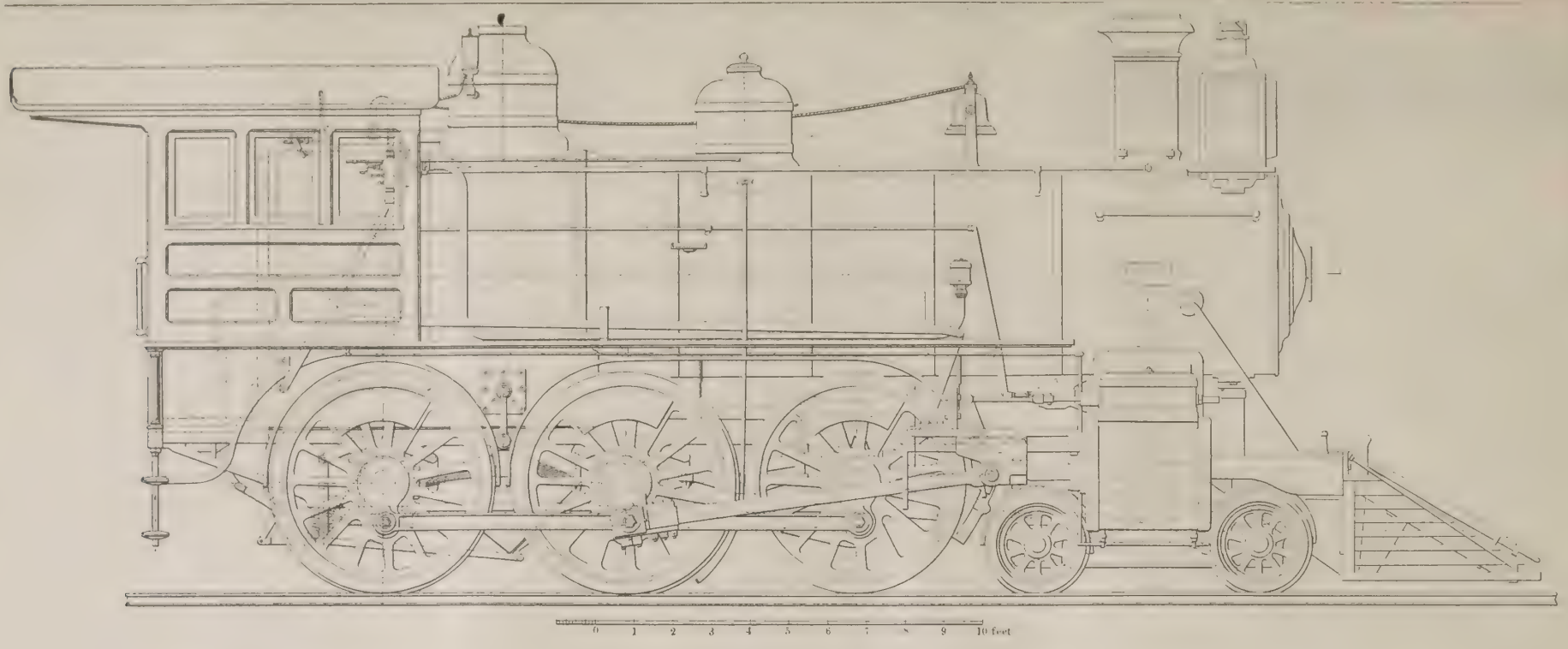


FIG. 1.

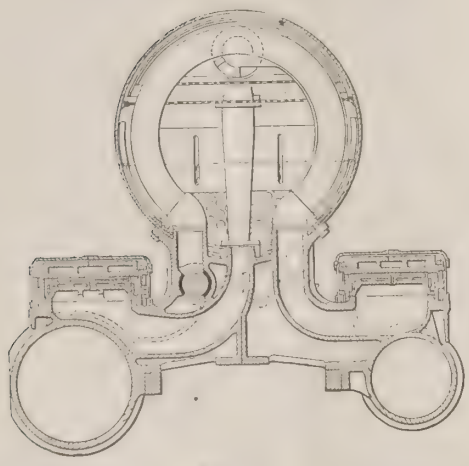


Fig. 2.

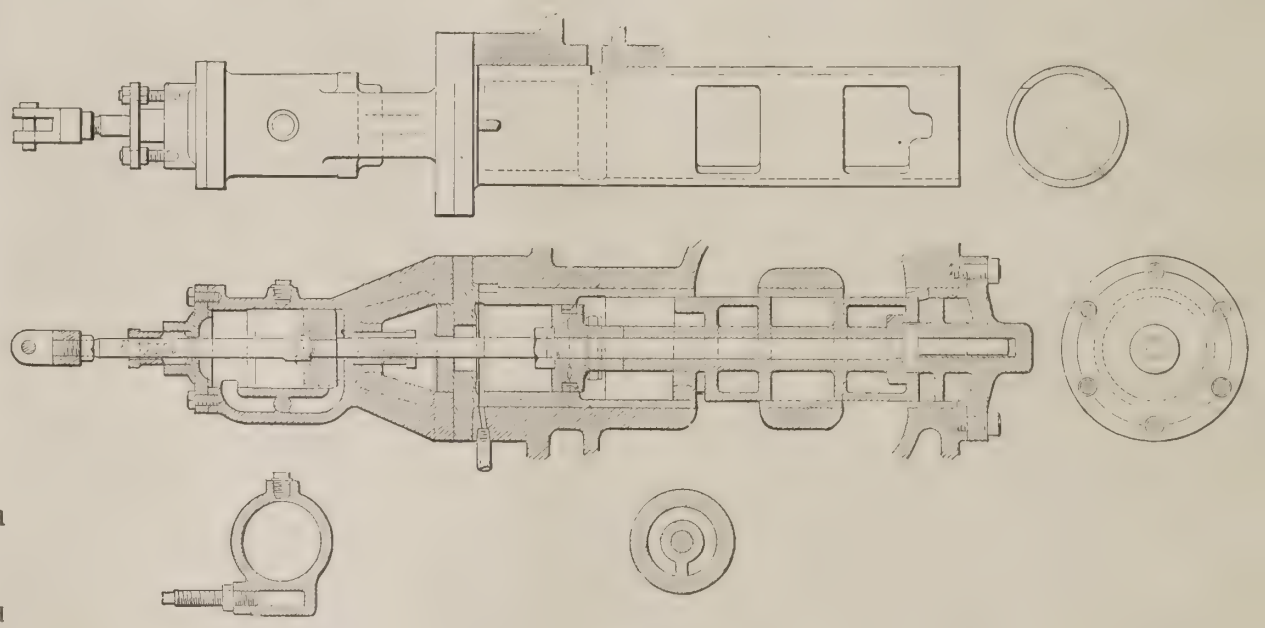


FIG. 3.

Working Tests of the Michigan Central Compound Looomotive.

BY ANGUS SINCLAIR.

The most comfortable and most punctually operated trains running between New York and Chicago are those passing over the Michigan Central Railroad. This admitted fact, and the numerous other attractions for travelers on this route, have caused so much increase of business lately, that about eighteen months ago the company's officers discovered that the capacity of ordinary eight-wheel engines to handle the fast passenger trains was more than reached. The trains are all heated with steam, and the resulting drain on the boiler is severely felt in bad weather, when the obstacles to maintaining punctual running time are greatest. Double-heading the trains was out of the question, and dividing into sections was regarded as being highly objectionable for many reasons, so the management determined to try ten-wheeled locomotives for the traffic. An order was given to the Schenectady Locomotive Works to construct a ten-wheel passenger engine as an experiment, and, when put in service, she performed the work so satisfactorily and economically that others were immediately ordered, and all the heavy fast passenger trains on the entire main line are now operated by locomotives of this class.

The economy resulting from the use of these engines was nearly conspicuous, but it did not convince those who had brought it about that the limit in this line was reached. The utility of compounding was receiving a great deal of attention, and they determined to reduce to a practical test the value of the compound locomotive, so after due consideration an order was given to the Schenectady Locomotive Works for a compound engine of substantially the some capacity as the ten-wheelers already in service. An engine of this type, designed by Mr. A. J. Pitkin, superintendent of the Schenectady Locomotive Works, was delivered toward the end of last year, and was put into freight service. About the time the engine was put to work the writer received from the officers of the Michigan Central Railroad an invitation to conduct a series of tests with the compound locomotive, to show as far as possible the relative economy of the engine, and to find out all that could be learned about the best way to work her.

To render the particulars of the tests made more intelligible to our readers, we reproduce some of the cuts used in the National Car and Locomotive Builder last month to illustrate the engine, and parts of the description of the same.

The high-pressure cylinder, which is 20 inches diameter, is located on the left side of the engine, the low-pressure cylinder, 29 inches diameter, being upon the right side, the right hand crank leading. The cylinders are cast with half saddles attached, and are bolted together, and to the frames and smoke box, in the usual manner; the arrangement of the guides, crossheads and running gear, as well as the valve motion throughout, does not vary from the ordinary forms of construction. In the right cylinder saddle is placed a multiple piston valve, called an intercepting valve, which, as its name implies, is used to control and govern the ingress of live or exhaust steam, as the case may be, to the low-pressure cylinder. The exhaust steam is conveyed from the high to the low-pressure cylinder through an arched pipe of horseshoe shape, passing from one saddle to the other around the inside of the smoke box, all shown very clearly in Fig. 2. This pipe, with the passages in the two saddles and the low-pressure steam chest, form the receiver. Great care has been taken to make all of the steam passages of ample area, and of such form as to avoid the reduction of pressure of the steam passing within them, and, in every case possible, the steam and exhaust passages have been separated by spaces between, to prevent loss of pressure due to radiation or condensation. As will be clearly seen later, the engine is designed to exert its full power at the moment of starting, and is capable of starting with the cranks upon either side of the engine upon the center. In fact, the engine cannot stop in any position whatever from which it will not start by merely opening the throttle. Referring to Fig. 3 of the illustration of the intercepting valve, it will be seen that it consists of three pistons working conjointly endwise in a brass bush or cylinder, which is pressed into the cylinder saddle. In this bush, as well as in the saddle, are two openings, top and bottom, through which the exhaust steam must pass as it traverses from the high to the low pressure cylinder. Near the back end of the bush, and on the inside, is a port which is connected through suitable passages and pipes with the live steam passage in the high pressure cylinder. In this pipe, and at the rear of the cylinder saddles, is introduced a pressure-regulating device, the office of which being to supply live steam to the low pressure cylinder at a reduced pressure, which bears the same ratio to the boiler pressure as the ratio of the two cylinders, respectively. It will be noticed that the rear piston of the intercepting valve is of a smaller diameter than the remaining ones, and that live steam is admitted to the interior of the brass bush between the two pistons of different areas, the preponderance of pressure being such that the valve will move forward. On the back of the saddle is bolted an oil cylinder or dash pot in which is a piston secured to a rod which is common to this piston and the pistons of the intercepting valve. This rod is carried backward, and connected to a lever fastened by a pivot to the side of the boiler, a rod running from the top of the lever to the cap serving as an index to the engineer of the position and working of the given parts. The rapidity of the movement, to and fro, of the intercepting valve is governed by a regulating device, consisting of a screw plug on the bottom and at the side of the oil cylinder, by which the opening in the port through which the oil flows, as it passes from one end to the other, may be enlarged or diminished at will. To increase the speed of opening and closing of the valve, the oil cylinder is counterbored in the center for a portion of the stroke, allowing the rapid passage of the oil by the piston during this portion, but nearing the end of the stroke the piston is cushioned and the rapidity is reduced in proportion to the amount of opening given to the oil by the regulating device.

The method of operation of the intercepting valve, which is entirely automatic throughout, is this: when the throttle is opened, live steam is admitted to the high-pressure cylinder, while at the same instant live steam passes through the reducing valve and port to the brass bush in the interior of the intercepting valve, and, as heretofore explained, forces the valve forward to the end of the stroke, thereby uncovering a live steam port in the lower side of the central piston of the intercepting valve through which the live steam passes on to the low-pressure steam chest, and thence into the cylinder. As the valve is forced forward it will be seen that all communication is shut off between the high and low pressure cylinders, thereby preventing the live steam from entering the high-pressure cylinder as back pressure. As the engine is now in operation, the exhaust from the high-pressure cylinder into the receiver accumulates above the intercepting valve, and through an opening in the upper side of the brass bush at the front, and exerts its pressure upon the front side of the forward piston of the valve, and overcoming the existing pressure of the live steam at the opposite end by means of the larger area, forces the valve back to the end of its backward stroke, cutting off the supply of the live steam, and forming a direct and free opening between the high and low pressure cylinders, and the engine continues to run compound until the throttle is closed. The cylinders for this engine are designed in the ratio of 2.1 to 1, the aim in the proportion of parts being to divide the work as nearly equal as possible on both sides of the engines.

The engine worked remarkably well for moderate speed as she was turned out of the shop, but indicator diagrams and the tests of train service demonstrated that a few

slight changes were necessary to produce satisfactory work at high speed. Very little information has been published about the details of the difficulties encountered by those who have put compound locomotives into use, and the men looking after the Michigan Central compound had to find out for themselves the minor defects and remedy them as they arose. The high-pressure valve originally had 1⅛ inch outside lap and no inside lap or clearance, while the low-pressure valve had 1⅛ inch outside lap and ⅛ inside lap. The high-pressure cylinder had 8½ per cent. of clearance space and the low pressure about 4 per cent. of clearance. The lead for both valves was $\frac{5}{32}$ inch. Owing to the small amount of clearance and the early valve closure for compression, the high pressure cylinder developed sufficient compression at short points of cut-off to prevent the engine from running freely. Improvements were sought in tentative fashion—cut and try. Under this process the inside lap was cut out of the low pressure valve and the high pressure valve given $\frac{3}{8}$ inch clearance. The lead of both valves was increased to $\frac{5}{32}$ inch and the clearance of the high pressure cylinder was increased to 10 per cent.

After these changes were effected the engine ran very freely up to a speed of 65 miles an hour, equivalent to 320 revolutions and 1,280 feet of piston speed per minute. There was no indication that this was nearly the limit of the velocity of the engine, but higher speed was not tried. Up to a speed of about 200 revolutions per minute the power developed in the two cylinders was sufficiently uniform for economical working, but when the velocity was increased much above that number of turns, the low-pressure cylinder performed the greater part of the work. This defect has been to a great extent remedied by the application of a larger receiver. That vessel was originally of the same measure as the high-pressure cylinder, and it was increased one-half with beneficial results.

The indicator diagrams which demonstrated the need for the changes mentioned were taken by Mr. Gifford, a mechanical engineer, from the Schenectady Locomotive Works and Mr. William Rosing, mechanical engineer of the Illinois Central Railroad, Chicago. Other diagrams from which Nos. 4 of the accompanying illustrations were selected were taken by Mr. Rosing and the writer, assisted by Mr. C. P. Wilkinson, chief draftsman of the Michigan Central locomotive department.

The pipes for the indicators were tapped into the ends of the cylinders and carried up to the top of the steam chest to a peculiar form of four way cock on which the indicator was secured. The movement of the handle of this cock puts the indicator in communication with either end of the cylinder, the steam chest or the atmosphere. The arrangement is convenient in some respects, but it entails rather too many movements by the operator. The pipes passing to the top of the steam chest make objectionably long connections, but with the wide spread of cylinders found in these engines it is impracticable to attach the indicator to the side of the cylinder. The men taking diagrams were in communication with each other, and with an assistant in the cab who noted data about the cards taken. The diagrams from both sides were always taken simultaneously.

The annexed diagrams will give our readers an idea of how the steam is distributed in a compound locomotive. They were taken under varied conditions of train service. We intend soon to give a series of diagrams illustrating the work done in the various stages of moving certain trains by a compound locomotive; but the data we have now at hand is too limited for this, and the diagrams given are shown merely to satisfy the curiosity which has induced many of our readers to apply to the writer for copies of the diagrams they had learned he had taken. Diagrams 1, 3 and 5 were taken when the engine was pulling a train of 30 freight cars loaded with dressed beef, weighing about 930 tons, from Jackson to Detroit. Diagrams 2 and 6 were taken when the engine was running the day express passenger train of seven coaches, weighing 175 tons; and diagram 4 was taken when the engine was hauling a train of 48 loaded freight cars, weighing 1,372½ tons, from Jackson to Detroit.

In the coal records made in ordinary train service it was found that the compound locomotive was considerably lighter on fuel than the other ten-wheel engines; but it was difficult to determine accurately the amount of saving when the coal and water were not weighed carefully. To make a reliable comparative test it was determined to run certain trains with the compound locomotive at a recorded speed and then run trains of the same weight at the same speed with one of the simple ten-wheel engines. The first runs of this kind were made with a train of eight passenger coaches from Jackson to Niles and back, a distance of 232 miles for the round trip. One run was made with the compound, and another with engine 282—one of the ten-wheel engines. The engines are the same in all particulars except the cylinder arrangment of the compound, and that No. 282 has the flue tubes six inches longer than No. 284, the compound. The weather conditions were nearly alike during the days of the trials.

The compound left Jackson at 9:08 A. M. and arrived at Niles at 11:59 A. M. One stop was made at Battle Creek, covering 4 minutes, and another stop at Kalamazoo, which occupied 8 minutes. Returning the train left Niles at 12:58 P. M. and arrived at Jackson at 4:17 P. M., four stops having been made on the way, occupying 4, 7, 8 and 13 minutes respectively. On the outward journey the run was made at the average rate of 43.7 miles an hour; on the return trip the average speed was 41.6 miles an hour.

Wood was used for raising steam and no coal was put into the fire-box till close on starting time, a practice that was followed with both engines. The quantity of coal used in this trip was 12,550 pounds, or 54 pounds to the mile. The ashes weighed 1,120 pounds, close on 9 per cent. of the total quantity of coal consumed.

Care was taken to see that the water in the boiler was the same height on returning as it was when the start was made. The total quantity of water used out of the tank was 113 inches, equal to 71,529 pounds.

Engine 282 made the run from Jackson to Niles on precisely the same time taken by the compound, and the delays were the same. Nor was there any difference in the return trip that would affect the record. On this round trip, the engine burned 14,300 pounds of coal, equal to 62 pounds to the mile and 13.6 per cent. more than what was burned by the compound. The quantity of ashes left was about the same in each case.

Engine 282 used 131¼ inches of water out of the tender in making the round trip. Each inch represents 633 pounds. The quantity of water used by the simple engine was 13.9 per cent. in excess of that used by the compound.

The compound evaporated 5.7 pounds of water to the pound of coal and the simple engine evaporated 5.8 pounds.

The water was gauged at frequent intervals during the trip, and the consumption indicated very clearly where the gain was made by the compound. In stretches where the engines had to be worked very lightly the compound used about the same quantity of water as the other engine. The compound cannot be worked to advantage cutting off short of half stroke. When the work is too light for half stroke it is better to keep the lever in that notch and throttle the steam than it is to attempt economy by linking up to a short cut off.

The track over which these tests were made is slightly undulating, with a few fairly heavy grades, but, on the whole, an excellent road to pull heavy trains over. The longest grade of any steepness is 36.4 feet to the mile for five miles.

The next tests made were hauling heavy freight trains from Jackson to Detroit and return, the single journey being 72 miles long. The train taken from Jackson by engine 284 consisted of 48 loaded cars and one way car, making a total load of 1,372½ tons, exclusive of engine. This train was taken to Wayne Junction, a distance of 56 miles, and then 6 more cars, weighing 107½ tons, were taken on, and the whole hauled the rest of the way.

In returning from Detroit the engine had a load of 751¼ tons.

The load of engine No. 280 from Jackson to Detroit was 1,233¼ tons. On the return journey she hauled 754½ tons.

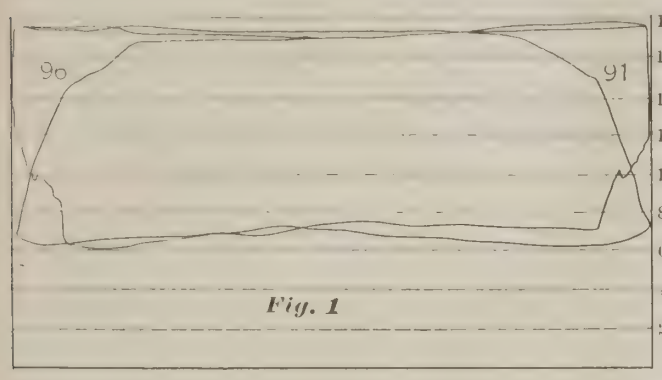


Fig. 1

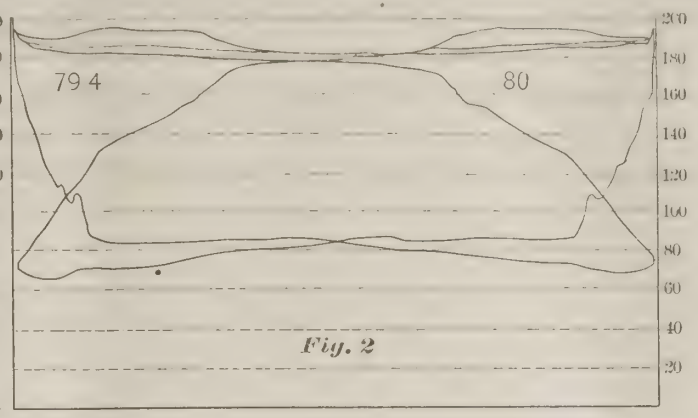
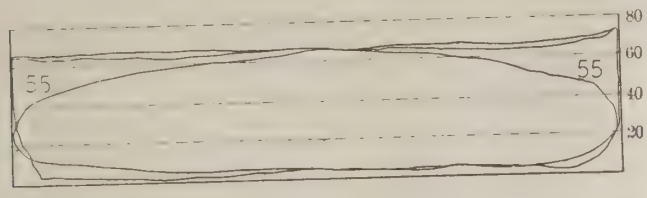
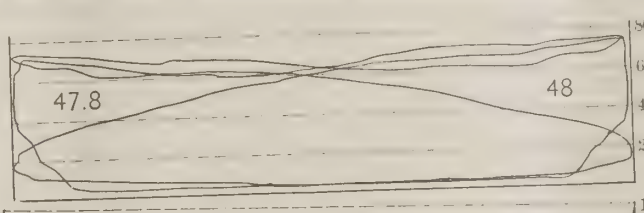


Fig. 2





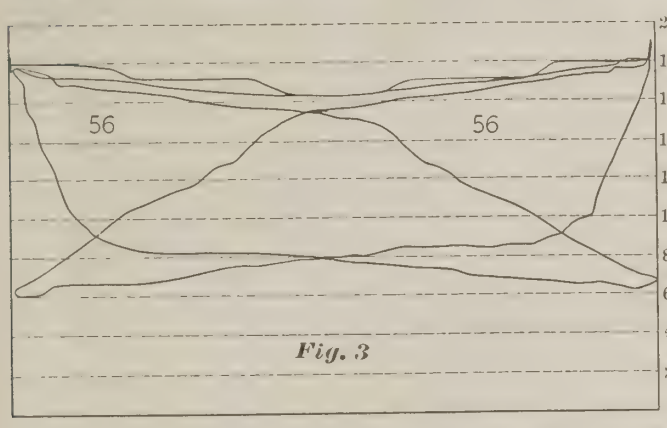


Fig. 3

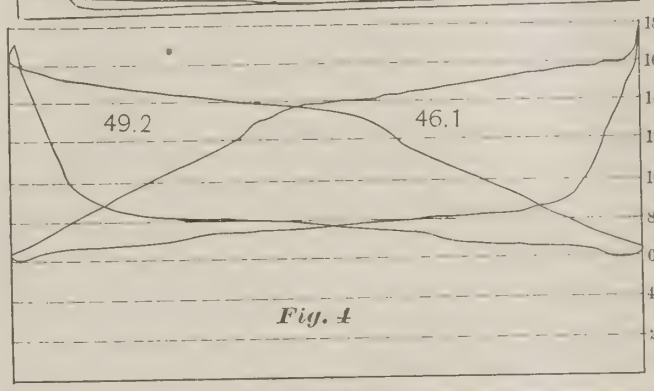
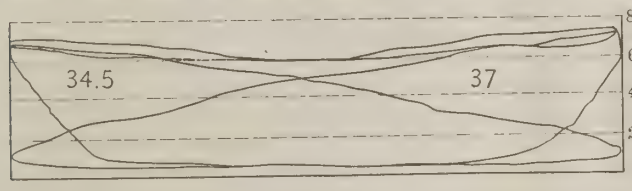
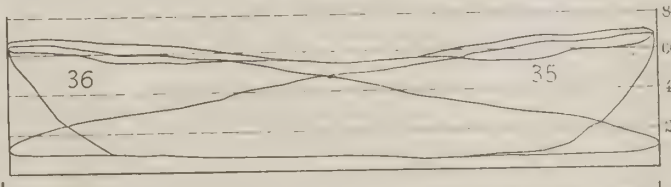


Fig. 4





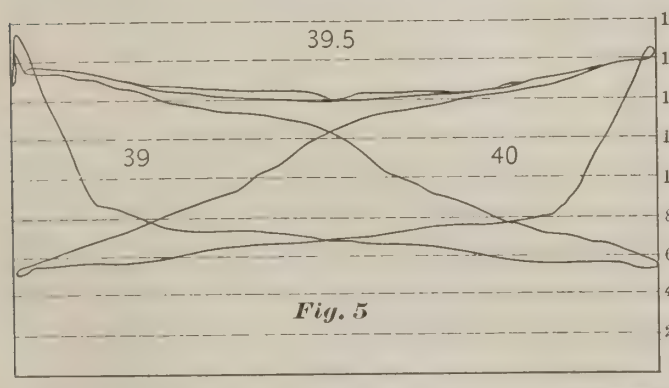


Fig. 5

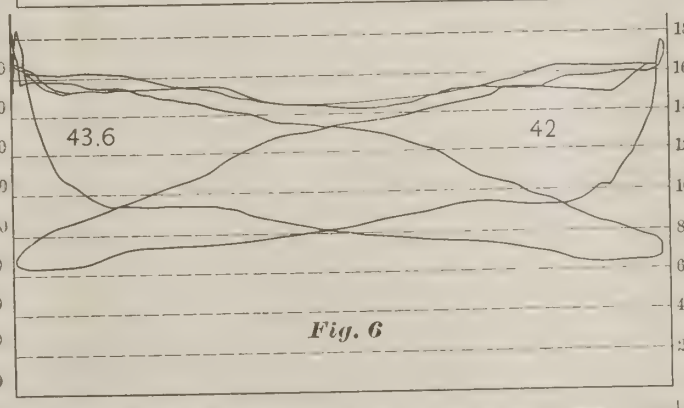
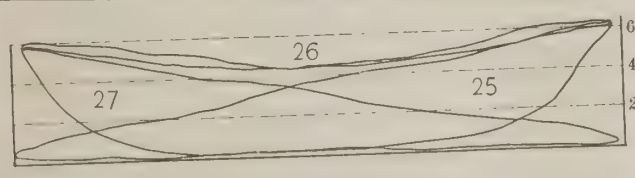
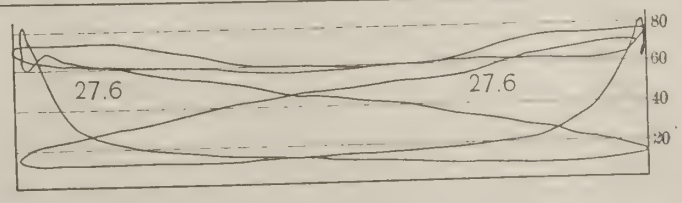


Fig. 6





The running time made by both engines was about the same in going to Detroit, but in returning the simple engine took 30 minutes more time than the compound. From Jackson the track rises for 13 miles at the average rate of 14 feet to the mile, making a steady heavy pull. From that point it descends with little change to Detroit at the rate of 13 feet to the mile.

The compound hauled on the first journey 39 tons for 56 miles and 163 tons for 14 miles in excess of the load pulled by the simple engine. In returning, the simple engine had the heavier load by 3¼ tons. In doing the work the compound burned 12,850 pounds of coal, and used 108½ inches, equal to 68,670 pounds of water, the evaporation being 5.3 pounds of water to the pound of coal. The simple engine burned 15,650 pounds of coal in the round trip and used 149¾ inches, or 94,791 pounds, the rate of evaporation being 6 pounds of water to the pound of coal. The simple engine used 18 per cent. more coal and 27.5 per cent. more water than the compound in doing the work.

The simple engine was exceptionally well fired, and the compound was badly fired during the trips with the heavy freight trains. The man firing the simple engine kept the steam close to the blowing-off point during the whole of the time, yet he watched his work so closely and performed it so intelligently that the safety valve did not blow once. The man of the compound appeared to think that keeping up steam was the sole purpose of a fireman's being, and he made the safety valve blow 17 times during the trips. I reckoned that the fireman of the compound wasted five per cent. of the fuel by inferior management of the fire. Both engines were exceptionally well handled by the engineers.

In running the day express train, consisting of seven cars weighing with the load about 250 tons, from Jackson to Michigan City, a distance of 153 miles, the compound used 9,100 pounds of coal and 49,532 pounds of water. On the same run engine 282 used 11,900 pounds of coal and 57,128 pounds of water. The saving of coal by the compound in comparison with the simple engine was 23.5 per cent. and the saving of water was 13 per cent.

When the compound has sufficient load to work cutting off at half stroke with an open throttle she can do the work with a saving of about 25 per cent. over the simple engine. Having to throttle the steam detracts from the economical performance of the engine. If this has to be done constantly a point is soon reached where compounding is of no advantage. The moral of this is that a compound locomotive ought to be designed for the work she is going to be engaged on.

INDICATOR DIAGRAMS FROM MICHIGAN CENTRAL COMPOUND LOCOMOTIVE NO. 284.

Diagram.	Gauge pressure.	Rev. per minute.	Miles per hour.	Throttle percentage of opening.	Cut-off in inches.	M. E. P. forward stroke.	M. E. P. backward stroke.
No. 1 H. P. cylinder	182	76	15 3	11.7	19¾	91	96
" L. P. "	182	76	15.3	11.7	19⅜	55	55
No. 2 H. P. "	180	100	20.2	29.5	16 9-16	80	79.4
" L. P. "	180	100	20.2	29.5	16 9-16	48	47.8
No. 3 H. P. "	182	124	25	11.7	14¾	56	56
" L. P. "	182	124	25	11.7	14¼	37	34.5
No. 4 H. P. "	170	156	31.6	29.5	12 3-16	46.1	49.2
" L. P. "	170	156	31.6	29.5	12 3-16	35	36
No. 5 H. P. "	170	176	35.6	7.2	12 3-16	40	39
" L. P. "	170	176	35.6	7.2	12 3-16	25	27
No. 6 H. P. "	180	200	40.4	7.2	13¼	42	43.6
" L. P. "	180	200	40.4	7.2	13¼	27 6	27.6

Coal Used For Steam Making.

Kuhlow, a German statistician, lately writing about the coal consumed by steam boilers all over the world, said there are about 800,000 steam boilers at work, producing about 10,000,000 horse-power per hour while at work. Of this number the half, or perhaps less, are stationary engines, working at most from ten to twelve to sixteen hours daily, and the remainder are on board steamers, working irregularly. On an average 6,000,000 horse-power per hour may be obtained from the consumption of coal. The coal required per horse power on an average is four pounds per hour—more for small boilers, less for the large ones. Consequently the coal consumption for the generation of steam may be estimated at 12,000 tons per hour.

A coal consumption of 12,000 tons per hour for steam boilers alone looks like using up the world's supply of fuel very rapidly, yet we think the estimate given to be very much below what is used. In North America alone there are at least 25,000 locomotives constantly at work. It is certainly not a high average to put the coal consumption of each engine at one ton per hour when at work. Ten hours a day may be considered a fair average of the time each engine is kept at work. At this rate we have 25,000 locomotives burning one ton of coal ten hours a day, making a total of 250,000 tons. This, spread over the 24 hours of the day, gives an average over 10,400 tons of coal per hour for the locomotive boilers of America alone.

It is no uncommon thing for educated people in Europe to be densely ignorant about everything connected with America, and it is likely enough that the statistician forgot about this continent when he was making a calculation of the fuel used by all the steam boilers in the world.

Freight Car Building.

A visit to the Peninsular Car Works, in the suburbs of Detroit, gives a man accustomed to mechanical operations a good idea of the difference between making and manufacturing as applied to car production. The time is not yet very far remote when a freight car was built in very much the same way that a country carpenter now builds a house, but under the system carried on in the works mentioned, the building of a car is as much a case of subdivided manufacture as is the production of a sewing machine. The works are admirably arranged for carrying on the manufacture of cars in the most methodical manner. The different departments are so controlled that each keeps working out its own contribution to the cars about to be erected, and mental machinery sets all the parts in motion and regulates their movement so that they reach the erecting shop just at the time they are needed. Rough lumber and pig iron and wrought iron keep coming in at one side of the works and busy hands guided by skill go to work upon them. As we follow the inanimate pieces we see them through the ordeals that transform them into finished parts. The lumber in passing through the planing mill turns into sills, plates, braces, posts, girths, carlines, bolsters, etc., all of the size and number required for certain orders, and the parts are all ready to be marshalled to their destination, the erecting shop. The pig iron is deposited in the flaming cupolas and in the foundry is converted into wheels, axle boxes, drawbars, brake shoes and into all the variety of cast-iron smaller parts that help to increase the weight of a freight car. The various parts as they leave the cleaning department pass to their respective workers and get drilled, bored, fitted, and finally marshalled with other parts to take their places on trucks or car bodies. The wrought iron, which is every week becoming of greater importance in car construction, is converted into axles, archbars, braces, rods, bolts, and the great variety of parts calling for strength and the elements of durability. Each part, as it leaves the blacksmith shop, passes to the artisan who puts the next mark upon it, and all the members go moving forward till they meet in truck or car body.

These works are at present building 31 cars a day, and in doing the work they use up about 100,000 feet of lumber, 48 tons of soft castings, 95 tons of wheel castings and 65 tons of wrought iron. Every improvement in car construction that calls for power brakes, improved couplers and stronger trucks increases the work to be done by the car builder, and every increase in the complexity of iron works adds greatly to the expense of production.

Every department in these works is equipped with the very best tools for facilitating production, many of them being very expensive tools specially designed for a recurring operation. A great deal of iron work is formed by bulldozers and similar horizontal tools, and many operations are done by modifications of bolt-heading tools. Special tools of Long & Alstetter make are very successfully operated.

It has only been by constantly devising special methods for getting out work cheaply that contract car builders have been able to compete with the favored home shops. In spite of the increasing labor called for by the improvements already mentioned, first class car builders have been able to do the work with the same amount of labor as was required when the car was a much simpler structure than it is to-day. At present 1,480 men are doing all the work connected with the building of 31 cars a day, so that each car represents the labor of one man for 48 days. At that rate it is difficult to figure out any profit in car building at present prices.

They have lately put up important additions to their erecting shops, and now have accommodation for 148 cars. They intend, in the near future, building a shop for bolt threading and rod threading alone.

The only special feature about the cars under construction is the increasing weight. Capacity to carry 60,000 pounds is now becoming a regular requirement. Strangely enough, the large M. C. B. axle is not often specified. About half the cars built have air brakes. Those having the M. C. B. coupler are a very small proportion of the whole. The ordering of iron brake beams is becoming very common. Many cars have an improved draft rigging specified.

The Cincinnati, New Orleans & Texas Pacific Railroad Company discharged sixteen conductors for belonging to the Brotherhood, and a committee appointed by Cincinnati to arbitrate on the case have recommended that the men be reinstated. The Order of Railway Conductors are blamed for having led to the discharge of the men, who had deserted their order to join a new organization with trades union sympathies.

Riveting by electricity has been successfully accomplished. The cold rivet is placed in the hole, and when heated to the proper temperature it can be closed by any of the ordinary apparatus now in use. The heating of a half-inch rivet of two or three inches in length takes about half a minute. Because this feat has been accomplished some electrical enthusiasts think that all boiler riveting will soon be done by electricity.

As Others See It.

Under the heading of "terrible alternative," the press dispatches recently contained the following item: "This afternoon, as the west-bound Nickel Plate passenger train reached the 150-foot high bridge over Walnut Creek, near Swantown, the engineer saw a man in the middle of the bridge. The train was running at the rate of forty miles an hour, and to reverse it on the bridge would have imperilled the train and its 100 passengers. Although the poor fellow stood wringing his hands in agony and looked pleadingly at the engineer, the brave man at the lever kept on and sent one man down 150 feet into eternity rather than imperil the lives in his keeping. The man was unknown and was penniless."

We are very much mistaken if Mr. John Mackenzie, Superintendent of Motive Power of the Nickel Plate, takes the same view of the engineer's bravery that the reporter did. In fact, it looks like a case of heartless recklessness, which ought to land the engineer in the penitentiary.

Tests of the Westinghouse Buffer.

The Union Switch & Signal Company have effected important improvements lately on the Westinghouse friction buffer, having made it double acting and materially altered it for the better in other respects. To give railroad men a good opportunlty to observe the working of this useful invention, the company some time ago fitted the buffer to 30 box cars of the heavy Pennsylvania pattern and exhibited the train at a number of leading railroad centers. Two heavy engines were attached to one end of the train and several brakes were firmly set at the other end. The engines were then worked together in exerting their full power pushing and pulling the train in turns. This gave the numerous spectators an excellent opportunity to watch the action of the buffer under great tension and compression. Very severe tests were made to demonstrate the ability of the gear to absorb great shocks without doing damage to the car, the couplings, or to the draft rigging. The tests consisted of breaking the train in two sections and crashing with one upon the other in the style common in some yards, but only with greater velocity than most switchmen dare to try. In some of these tests the onlookers confidently expected to see some broken couplers at least, and Mr. Buhoup, the agent of the Janney coupler, with which the cars were equipped, was rather nervous when he saw the cars coming together, but the shocks did no harm. The buffer transferred the blow gradually to the resisting elements, and its force was expended harmlessly.

The purpose sought by the inventor and improvers of the buffer is to provide on the draw-gear an elastic apparatus sufficiently powerful to resist the heaviest blows imparted in the handling of cars. Where springs alone are employed considerable length of movement is necessary to combine elasticity with the power that will resist a blow of about 20,000 pounds. By using the friction plates which are the special feature of the Westinghouse buffer, the maximum resistance is obtained with the smallest possible yielding movement. The buffer will soon pay for itself in saving of drawbar rigging.

Cheek is no Name for it.

Some few issues back the National Car-Builder warned inventors not to do business with patent venders, who, under the pretense of selling, only defrauded them. One of these concerns copied the article with approval, and then adds that they do not ask any fee in advance; they are "satisfied with a fair commission" in case of success. In another part of their advertisement they announce that a fair commission is 33 per cent. on the sale of the patent, and 25 per cent. where arrangements are made to manufacture on royalty. Considering that an inventor is very fortunate to obtain 25 per cent. on the profits of an invention sold upon royalty, it would be interesting to know how he is to pay the agent 25 per cent. "during the life of the contract."

Women are sometimes laughed at for their want of business capacity and knowledge of detail in mercantile transactions, but here is a patent agent, or, rather, a vender of patents, who boldly claims 25 per cent. of the profits, leaving the inventor and manufacturer to share the other 75 per cent. as they can agree. Cheek is no name for it.—*Engineer* (*New York*).

A correspondent writes us asking if we will furnish a mathematical solution of what he calls mechanical puzzles. We have too many editorial problems to solve monthly to permit us to work at the puzzle-guessing industry, but if any of our readers care to send us an explanation worked out we shall gladly give it to our readers. Our correspondent says: "Why is it that an emery wheel out of true works out of balance with violent vibrations shortly after starting, and then after the speed rises settles down to business without any perceptible jar? I would like to have this thing mathematically demonstrated. Also why it is, that if you run an unbalanced disk at a speed of 300 revolutions a minute, the heavy side will be marked by a piece of chalk held to touch the circle of rotation, and when the speed is increased to 600 revolutions the light side will touch the chalk. This is a fact, although it may appear odd."

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Seventh Paper.

THREE-CYLINDER COMPOUND LOCOMOTIVES.

The first question which naturally arises in beginning the consideration of three-cylinder compound locomotives is, what are the reasons why that form should be selected in any case in preference to the two-cylinder type, which is evidently so much more simple? In answer to this, it may be said that the expansion of steam can be carried further in some designs of three-cylinder engines than in the two-cylinder type without using cylinders which are excessively large, and, therefore, that the advantages of high-pressure steam can be more fully realized. The ratio of the volume of the low-pressure cylinders to the high-pressure can be made greater than is practicable with two cylinders, and a more nearly equal distribution of work can, therefore, be obtained. By a proper arrangement of cranks a more uniform rotative power can be secured, and further, a better distribution of weights can be obtained than is possible with the two-cylinder outside connected type.

To avoid possible misunderstanding, attention is called to the distinction between three-cylinder compound engines and triple expansion engines. In the latter the steam performs work in three cylinders in succession, the high-pressure, the intermediate, and the low-pressure. In the former, when released from one high-pressure cylinder the steam is divided between two low-pressure cylinders, or else the exhausts from two high-pressure cylinders unite in the receiver and further expansion takes place in one low-pressure cylinder. In general the name compound is given to those engines in which the steam acts in but *two* cylinders in succession, whether two, three or four cylinders are used, while triple and quadruple expansion mean that the steam is used in three or four cylinders in succession.

The two possible arrangements of three-cylinder compound engines have been applied to locomotives; that with one high-pressure and two low-pressure cylinders by the Northern Railway of France, while that with two high-pressure cylinders and one low-pressure is the arrangement of the well-known Webb compound.

Steam Distribution in Three-Cylinder Compound Locomotives.—The fundamental theory of three-cylinder compound engines does not, of course, differ from that of two-cylinder compound engines. The only differences which

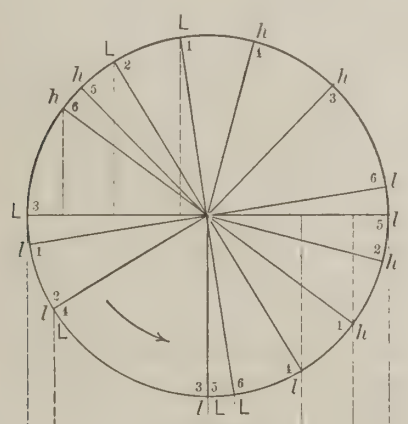


Fig. 29

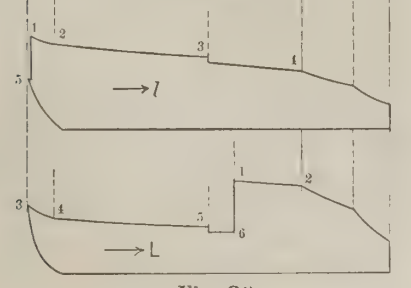


Fig. 30

exist are the result of the relative angles of the cranks, and are to be found in the variations in the turning moments and in the variations in pressures in the receiver. Each case must be individually analyzed, and the only difference between such analyses and those already given for two-cylinder engines is the greater complication which arises from having three cranks to consider instead of two. As an example of the method to be preferably followed in attempting such an investigation, an arrangement of cranks which has been used for a locomotive is selected. In this form the low-pressure cranks are at right angles and the high-pressure crank makes angles of 135 degrees with them. In the first place we assume the following data: In the high pressure cylinder, cut-off, .75; release, .90; compression, 90; in the low-pressure cylinders the same distribution.

In Fig. 29 are shown successive positions of the three cranks, *h* representing the high-pressure crank, *L* one low-pressure crank, and *l* the other. Assuming the direction of the revolution to be as indicated by the arrow, an exhaust takes place from the high-pressure cylinder when its crank is at h_1. One low-pressure crank, l_1, is then just commencing a stroke, and the other, L_1, has accomplished about .57 of a stroke, the effect of the angularity of the connecting rods being neglected. From these positions there is free communication between the three cylinders and the receiver until *L* moves to L_2, where the cut-off takes place in that cylinder, the other low-pressure crank being then at l_2 and the high-pressure crank at h_2. From these positions expansion continues in the cylinder *L*, while there is still free communication between the other low-pressure cylinder, the receiver and the high-pressure cylinder until the low-pressure crank *L* arrives at L_3, when steam is again admitted to that cylinder for the return stroke. The other low-pressure crank is then at l_3, and the high-pressure crank is at h_3. All three cylinders are now again in communication, and remain so until the cut-off position l_4 is reached, the other cranks

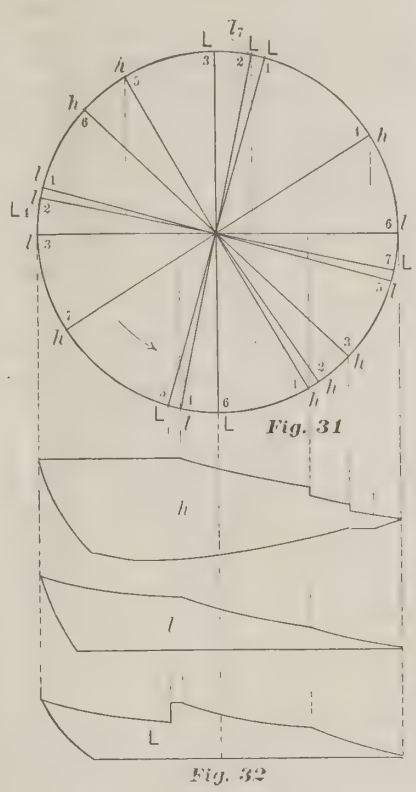


Fig. 31

Fig. 32

then being at L_4 and h_4. The two cylinders which are represented by *h* and *h* remain in communication until the positions numbered 5 are reached, when steam is again admitted to the cylinder *l*. Soon after this the high-pressure exhaust takes place at h_6, and a fresh supply of steam is admitted to the receiver, from which it enters both low-pressure cylinders whose cranks are at L_6 and l_6. These positions correspond to those numbered 1, the direction of the piston movement only being changed. It is clear that, when the exhaust takes place from the high-pressure cylinder, the low-pressure piston corresponding to *l* is always near the beginning of a stroke, while the other is near the middle of its stroke. The effects of this distribution in the low-pressure cylinders are shown in Fig. 30 by indicator cards, which are constructed on the assumption of rapid valve movements and neglecting the irregularities which are caused by the connecting rods. The cards are not drawn to a scale and the variations in pressures are purposely exaggerated. With a relatively large receiver the drop in pressure at l_3 and L_5 will be very small. In practice the readmission at 1 would produce a hump in the card *L*, while the card *l* would have a form which would apparently indicate that the valve was late in opening.

At earlier points of cut-off somewhat different results will be found. These are illustrated by Figs. 31 and 32, in which it is assumed that cut-off takes place at .4 and release at .75 the stroke in all three cylinders. Taking the direction of revolution as before, when release occurs in the high-pressure cylinder at h_1, one low-pressure crank is at L_1 and the other is at l_1. A very slight movement brings the crank *L* to its cut-off position L_2, soon after which steam is admitted to the other low pressure cylinder at l_3, and that cylinder is in communication with the receiver and the high-pressure cylinder until its cut-off point is reached at l_4. There will then be slight compression in the high-pressure cylinder and the receiver until steam is admitted to the *L* cylinder at the beginning of its next stroke. The remaining events of the revolution are similar to those already noticed and will be made clear by a study of Fig. 31. It will be seen that there is still readmission to the low-pressure cylinder *L*, but that this does not affect the form of the card from the other low-pressure cylinder. With this arrangement of cranks and with the same valve adjustment the indicator cards from the two low-pressure cylinders will be unlike for all points of cut-off. There is in fact but one arrangement of cranks for which the distribution in the low-pressure cylinders will be the same, and that is when the low-pressure cranks are both at right angles with the high-pressure, and therefore either directly opposite each other or parallel. Assuming an equal division of work between the three cylinders, the most uniform turning moment would be obtained by placing the cranks at angles of 120 degrees with each other, but the difference in the distribution in the two low-pressure cylinders will still exist, although it is not probable that this will be of great importance at ordinary running speeds.

An examination of the crank positions for the form of three-cylinder engine having two high-pressure cylinders and one low-pressure cylinder shows similar peculiarities in the distribution. This will be evident from Figs. 33 and 34, which are lettered similarly to Figs. 29 and 31, *H* and *h* representing the two high-pressure cranks, which are at right angles, and *l* the low-pressure crank, which makes angles of 135 degrees with the others. The distribution in Fig. 33 is the same as that in Fig. 29, and that in Fig. 34 is the same as that in Fig. 31. It will be seen that there is readmission to the low-pressure cylinder in both figures; but at the earlier cut-off of four-tenths it is not probable that the effect on a low-pressure indicator card would be noticeable. Placing the cranks at angles of 120 degrees would, as in the first arrangement of cylinders, produce very little change in the indicator cards.

It is evident, from the preceding partial analysis of the steam distribution, that the construction of theoretical indicator cards for three-cylinder compound engines will be considerably more difficult than for the two-cylinder type, but that the same formulas and methods of construction can be used. The remarks which were made in discussing two-cylinder compound locomotives in regard to the effect of varying the capacity of the receiver, and the results of changing the points of cut-off are equally applicable to three-cylinder engines. In fact, the only differences are those in the steam distribution, which have been already discussed, and which depend upon the angles made by the three cranks.

A mathematical discussion of the three-cylinder type of compound engine, having one high-pressure cylinder and two low-pressure cylinders, and with the cranks placed at angles of 120 degrees with each other, will be found in the appendix to "The Marine Steam Engine," by R. Sennett. The form having two high-pressure cylinders and one low-pressure cylinder does not appear to have been used in marine practice, and its use is not to be expected, inasmuch as one of the chief reasons for using three cylinders instead of two is to avoid excessively large low-pressure cylinders.

In attempting to determine the size of cylinders for three-cylinder compound locomotives, the best guide will undoubtedly be the results obtained with locomotives of that form in practice. When such information is not obtainable, the most satisfactory method will be that advocated under similar circumstances for two-cylinder compound engines, *i. e.*, the construction of, what were called for convenience, theoretical indicator cards, and the alteration of these as experience dictates, to allow for wire drawing during the opening and closing of valves, drop in pressure, etc. The proportions which appear to have been generally adopted by Mr. Webb are, high-pressure cylinders, 14 inches in diameter; low-pressure cylinder 30 inches in diameter; stroke of all pistons, 24 inches. The ratio of the volume of the low-pressure cylinder to that of both high-pressure cylinders is thus about 2.3. Assuming a mean forward pressure of 175 pounds gauge, in the high-pressure cylinders, and a back pressure in the low-pressure cylinder of 3 pounds above the atmospheric pressure and an equal division of work, we can make an approximate estimate of the maximum power of the

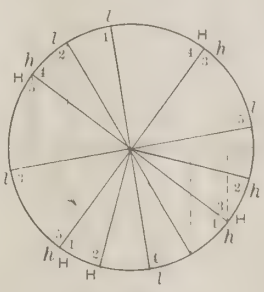


Fig. 33

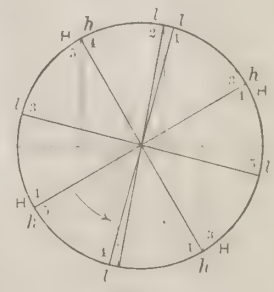


Fig. 34

engine as follows: The area of the low-pressure piston is 4.6 times that of one high-pressure piston, and, if the work is to be the same in both, the mean pressure in a high-pressure cylinder must be 4.6 times that in the low-pressure cylinder. As the total range of pressure is 172 pounds, and as the mean receiver pressure is approximately the same as the mean high-pressure back pressure and the mean low-pressure forward pressure, we have: $4.6 \times$ l. p. mean effective pressure = 172—l. p. mean effective, whence l. p. mean effective = $172 \div 5.6 = 30.7$ pounds. The mean receiver pressure is then $30.7 + 3 = 33.7$ by gauge, and the mean effective in the high-pressure cylinders is $175 - 33.7 = 141.3$ pounds. A similar calculation can, of course, be made with any assumed mean forward pressure, and this method can also be used for making an approximate comparison of the maximum work done in the cylinders of the three-cylinder compound with that in ordinary locomotives. For example, if the mean forward pressure in the latter is 150 pounds and the back pressure is 3 pounds as before, the total effective pressure during a stroke will be $2 \times 147 \times$ area of one piston. To be the equivalent of the compound locomotive this must equal $3 \times 141.3 \times$ area of one high-pressure piston. This gives in the present case,

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221.9 square inches as the piston area of the simple engine, or in other words a simple engine having two cylinders about 16.8 inches in diameter would be equal in power, with the assumed pressures, to the compound engine having cylinders 14, 14 and 30 inches in diameter, the stroke being the same in all cylinders.

The same method can be used to find dimensions for an equivalent three-cylinder engine having one high-pressure and two low-pressure cylinders. If the ratio of the volumes of the two low-pressure cylinders to that of the high-pressure cylinder is 2.3, each low-pressure cylinder will be 1.15 times as large as the high-pressure. Therefore 1.15 × l. p. mean effective pressure = 172 — l. p. mean effective, whence l. p. mean effective = 80 pounds. The mean receiver pressure will be 83 pounds gauge, and the h. p. mean effective pressure will be 175 — 83 = 92 pounds. To find the piston areas we have 92 × area of the high-pressure piston for this engine = 141.3 × area of a 14-inch cylinder, which gives an area of 236.3 square inches, 17.35 diameter, for the high-pressure piston, and 1.15 times this or 271.8 square inches, 18.6 diameter, for each low-pressure piston. An engine having one high-pressure cylinder 17.35 inches in diameter and two-low pressure cylinders 18.6 inches in diameter, is thus equivalent with the assumed pressures to one having two high-pressure cylinders 14 inches in diameter and one low-pressure cylinder 30 inches in diameter. The distribution of work among the three cylinders will be considered in a subsequent paper.

ILLUSTRATIONS OF THREE-CYLINDER COMPOUND LOCOMOTIVES.—Before discussing other special features of three-cylinder compound locomotives, illustrations of the two forms will be given. The compound locomotive having one high-pressure cylinder and two low-pressure cylinders, which was built by the Northern Railway of France, and to which reference has already been made, was illustrated in *Engineering*, of Dec. 6, 1889. The general arrangement of the cylinders and steam connections of this locomotive is shown in Fig. 35. Referring to this figure *h* is the high-pressure cylinder; *l*, *l*, are the low-pressure cylinders; *A* is main steam pipe to the high-pressure cylinder; *C*, *C* is the receiver; and *D D* are the low-pressure exhaust pipes. The low-pressure cylinders are placed as usual and have the valve chests above. The high-pressure cylinder is placed below the smoke-box with its valve chest *B* below it, and is inclined at an angle of one in ten. The locomotive is of the Mogul type, having six coupled driving wheels, the middle axle being the main driving axle for all three cylinders. The low-pressure cranks are at right angles, and the high-pressure crank is midway between them, thus making an angle of 135 degrees with each low-pressure crank. It will be noticed that the receiver is formed in the cylinder castings, and not by pipes, as in the locomotives previously illustrated. The high-pressure valves are a special feature of this engine. These consist of a main valve and a cut-off valve, which slides on the back of or

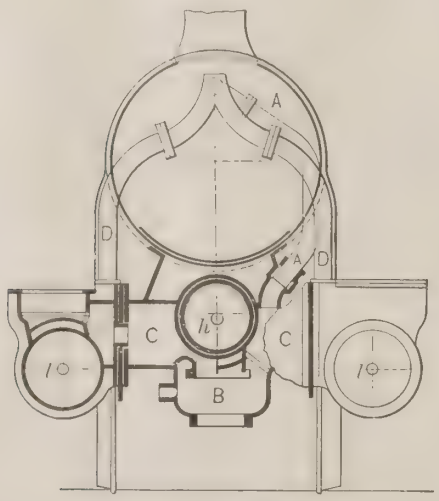


Fig. 35

below the main valve, the whole forming a combination which in principle is the same as the Meyer and Ryder cut-offs. The edges of the cut-off valve form an oblique angle with the axis of the cylinder, as in the Ryder valve gear, and the ports in the main valve are correspondingly inclined at the back of that valve, but are twisted so that on the face next to the cylinder they are placed as is customary. The edges of the exhaust port in the cylinder casting are, however, inclined, and the exhaust cavity in the main valve is formed to correspond. The yoke which drives the main valve does not fit it at the sides, and so permits a transverse movement while controlling it longitudinally. A second yoke incloses the valve, and permits a longitudinal movement, but holds it transversely. This yoke is connected to a stem, which passes through a stuffing-box in the side of the valve chest, and is operated from the cab by lever connections. It is clear that the high-pressure cut-off can be adjusted at any time, by means of this connection, while the valve is so proportioned that in its extreme position the steam and exhaust ports remain open for all positions of the high-pressure piston, and steam is thus allowed to blow through the high-pressure cylinder without doing work. The engine can, therefore, be started by the low-pressure cylinders with steam from the boiler, the high-pressure piston being then practically inoperative; and as the low-pressure cranks are at right angles, the starting conditions will be the same as for a simple locomotive. The principal dimensions of this locomotive are as follows:

Diameter of high-pressure cylinder (original)	18.11 inches.
" " " " (present)	17 "
" " low-pressure cylinders (2)	19.69 "
Stroke of all pistons	27.56 "
Diameter of driving wheels	64.9 "
Boiler pressure, gauge	199 pounds.
Diameter of boiler, smallest inside	52.3 inches.
Tubes, 208, 1.77 inches, length	13 ft. 1.48 inches.
Grate area	22.5 sq. ft.
Heating surface	1224.9 " "
Weight in working order, total	106,176 pounds.
" " " on driving wheels	90,944 "
Low-pressure, valve gear	Walschaert.
Exhaust nozzle, 4.21 inches in diameter, originally	5.51

The general arrangement of the cylinders and steam connections of compound locomotives of the Webb system

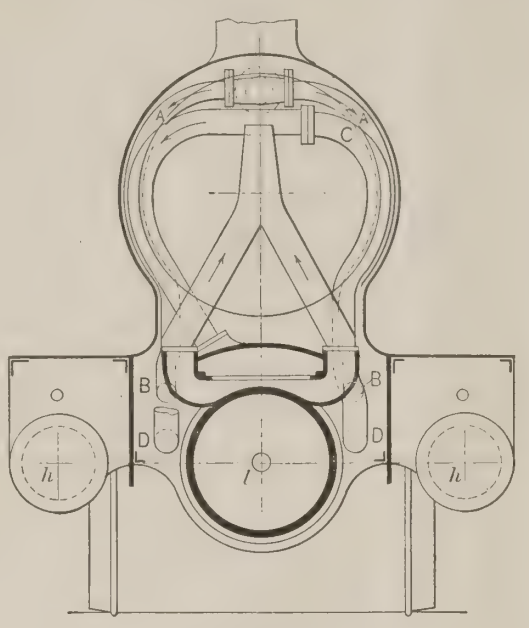


Fig. 36

is illustrated by Fig. 36. In this figure *h h* are the high-pressure cylinders, which are placed so that the centers are in a transverse line about four feet back of the front tube sheet, and which are connected to the second pair of driving wheels. The low-pressure cylinder *l*, is placed beneath the smoke box and is connected to the forward pair of driving wheels. The course of the steam from the boiler is through the pipes *A A* to *B B*, and thence back to the high-pressure cylinders. The exhaust from these cylinders is led through the pipes *D D*, and thence around the smoxe box through two pipes *C* to the low-pressure steam chest. The course of the exhaust from the low-pressure cylinder is clearly indicated in the figure. The disposition of the cylinders and steam pipes is essentially the same in the Webb compounds for passenger and freight service. The most noticeable peculiarity of the system is the absence of driving connection between the high and low-pressure axles, there being no coupling rods on engines having two pairs of driving wheels. In one design for freight service there are three driving axles, the first being driven by the low-pressure cylinder, and the second and third, which are coupled, being driven by the high-pressure cylinders. It will be seen that even in this case there is no connection by coupling rods between the high and low pressure cylinders. The principal dimensions of a recent Webb compound locomotive are as follows:

Diameter of high-pressure cylinders (2)	14 inches.
" low-pressure cylinder	30 "
Stroke of all pistons	24 "
Diameter of driving wheels (4)	75 "
Boiler pressure, gauge	175 pounds.
Diameter of boiler, smallest inside	49 inches.
Tubes, 235, 1⅞ in., length	11 ft. 3 in.
Grate area	20.55 sq. ft.
Heating surface	1456.7 "
Weight in working order, total	99,350 pounds.
" " on driving wheels	66,700 "
Valve gear	Joy
Exhaust nozzle	4¾ in. in diam.

Letters patent have been granted to J. Davis, of Altoona, Pa., for a machine for milling valve ports. The salient part of the claim is a machine for finishing valve face ports, the combination of a supporting frame adapted to be temporarily fixed upon an engine cylinder, an upper and lower carriage fitted to traverse at right angles, one to the other, in said frame, feed screws actuating said carriages, a cutter shaft journaled in the lower carriage, a series of milling cutters fixed upon said shaft, a shaft carrying a driving pulley and journaled in the lower carriage, and gearing connecting said shaft with the cutter shaft.

While many northern cities are crowding out manufacturing establishments through the heavy burden of taxation habitually saddled upon them, cities in the South and West are drawing to themselves the manufacturers that other sections failed to hold at their true value. There is every reason to believe that the new locomotive works about to be built near Chicago will have as neighbors several important machine-making works that are being crowded out of New England cities.

Color-blind Agitation in Britain.

The scientific oculists of Great Britain have been working up a color blindness agitation similar to which was inflicted upon this country a few years ago. They have been striving to alarm the traveling public with assertions that great dangers exist through the prevalence among trainmen of color blindness, and a demand has been made that all the men having to deal with signals shall have their vision tested by the Holmgren wool test handled by experts. On the other hand, the British Board of Trade keeps an accurate record of the cause of all railway accidents, and this makes out that no accidents have been caused by color blindness. Mr. Clement E. Stretton, a representative of railway labor interests, writes to the *Engineering* as follows:

The "dot and wool" test, as a matter of fact, is useless for testing the sight of railway men, for the simple reason that it is not practical and furnishes no proof as to the man's good or bad sight.

Railway companies do not paint a group of dots upon the arms of their signals, nor do they hang skeins of colored wool upon their signal posts, nor do they use fifty colored lights.

The only possible way to know if a railway man can see signals is to take him upon the line and put him through a proper, fair and severe practical test by requiring him to see signal arms by day, and red, green, white and purple lights by night, at any necessary distances from a few yards to a mile; the man must pass such a test when the weather is fine and when it rains. Let the man be tested with practical signals under all practical circumstances, but do not let him be disqualified as an engine-driver because he cannot sort wools as well as a lady in a Berlin wool shop.

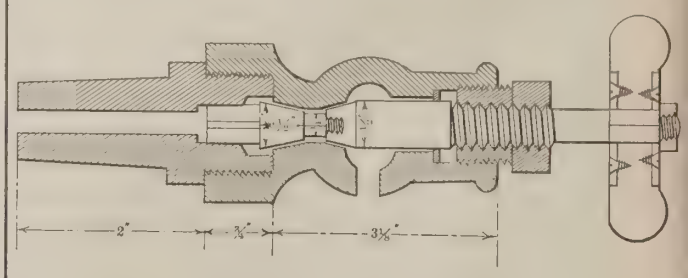
As a matter of fact a number of railway men who have failed in the "wool" test, and are therefore called color-blind, have gone to Berlin wool shops and obtained instructions, after which they have been able to pass the wool tests with the greatest ease.

The roundhouse of the Carolina Central, at Charlotte, N. C., was burned Feb. 11. Two locomotives were destroyed. The insurance was $20,000.

A correspondent acting for a locomotive engineer has written us for a recipe for some mixture that can be put in a smoke box to keep the joints tight. As others may be looking for something of the same kind we wish to say that the cement made by the Otley Mfg. Co., Chicago, is the best thing we know of for the purpose.

It is reported that the Chicago & Northwestern Railway Company intend to manufacture the greater part of the paint required for bridge, building and rolling stock work. The claim is made that the company can manufacture the paint cheaper than they can buy it. We have seen claims of this sort advanced by railroad companies in regard to nearly all the supplies required for use. Many have tried the experiment of becoming manufacturers, but the result has nearly always been that after spending a great deal of money on plant, they returned to the practice of buying in the open market.

The gauge cock illustrated in the annexed engraving has been designed by Mr. W. A. Gore, a bright young engineer on the Chesapeake & Ohio Railroad. In explaining the need which produced this invention, he said: "The inconvenience and annoyance of gauge cocks of the present patterns to engineers when they become leaky, necessitating the cooling down of the boiler before they can be ground, calls for something more convenient. In the engraving the gauge cock is formed in two parts, the stem which screws into the boiler forming a guide for the check valve. The main valve has a ¼-in. square pin screwed into it, sufficiently long to keep check off seat at all times, unless when necessary to grind or pack. When the stuffing nut is screwed back, along with stem, the check follows it until seated, when, with a monkey wrench, the small square pin is removed and valve seat ground. The sudden rush of steam and water past check will prevent its getting clogged up with mud or sediment."



Improved Gauge Cock.

The Peninsular Car Works are working on a large order of cars for the Denver & Rio Grande. They are also building cars for the Union Pacific, the Rock Island & Pacific, and the New York, Lake Erie & Western. The Union Pacific and the Denver & Rio Grande cars have air-brake equipments, and the Chicago, Rock Island & Pacific and the Erie cars have Janney couplers.

Solid Pressed Steel in Car Construction.

At the February meeting of the Western Railway Club Mr. E. W. McHughes read a paper on the above subject. He held that

Improvements in construction can only be effected and made successful provided it fulfills three main conditions: In the first place, greater simplicity in construction than previously; in the second, greater economy either in manufacture or maintenance, or in both; add to these decreased weight, increased strength, and a reduction in parts making up the whole. I do not know of any invention of late years that so meets with all the requirements to achieve success as pressed steel in locomotive and car construction.

A solid pressed steel plate is produced complete and perfect at one heat, of sufficient rigidity, transversely and longitudinally, so as to do away with the use of angle irons, and thus reduce the weight and cost of manufacture.

I will now proceed to notice the practical and commercial considerations bearing on the subject of pressed steel. One of the most important desiderata in connection with car construction in those days of low tariff rates is lightness. Pressed steel goes direct to this point, as it reduces dead weight to be hauled. I cannot better demonstrate this argument than by reference to actual forms now in the room, I mean these center plates. They vary in weight according to design, as do the original cast plates they replace. In sample No. 1 we have a pair of steel plates weighing 27 pounds, which have been used to replace cast metal plates weighing 138 pounds; sample No. 2 weighs 45 pounds and replaces 161/2 pounds.

All these samples will carry the heaviest cars in service, so I will take the first alluded to, which gives a saving of 222 pounds per car, or a total saving per train of 30 cars of no less than 6,660 pounds saved by the use of this small portion of a car.

Going further, and taking a whole truck, we will see the advantage gained in weight. The passenger truck diagram No. 111 weighs 7,339 pounds. I would take the average weight of an ordinary 4-wheel passenger truck of the present day at about 8,286 pounds, giving an advantage to the pressed steel truck of about 947 pounds, or a total saving in dead weight to be hauled in a train of six cars of about 11,364 pounds.

We next come to the freight trucks. The truck shown in diagram No. 16 is designed to replace an ordinary rigid bolster truck of the diamond type. It weighs 4,600 pounds; against a composite built truck of rigid bolster form which may be taken at 5,200 pounds, which would give a car mounted on steel trucks the advantage in weight of 1,200 pounds, or on a train of 30 cars, 36,000 pounds.

Diagram No. 146 illustrates a novel form of freight truck. We have nothing to compare it with, unless we take a passenger truck, for in this case we are offering for freight service a truck that might, and will, carry a passenger coach. The object aimed at in this truck has been to relieve it of the severe concussions that are delivered on the truck with a journal box rigid in the frame. This point is attained, as will be seen by placing the springs in the side frames and conveying the load through them to the journals direct, by the introduction of equalizers.

This truck can be built either with or without end sills. We may compare it for weight without ends to a diamond truck. It is estimated to weigh 5,115 pounds, and the weight of a diamond truck to carry the same load (60,000 pounds) may be taken at 5,205 pounds. Thus we have 90 pounds in favor of the steel truck which is carrying equalizers weighing 280 pounds. In other words, we have a truck for freight service in which are contained portions that at the present time only exist in passenger service, and yet the weight is less by 90 pounds than the ordinary rigid bolster diamond truck.

Economy in maintenance is arrived at by the use of pressed steel in car construction. A standard design having been fixed upon, each part can be produced an indefinite number of times with perfect exactitude. Spare parts can therefore be held, and replacements effected without delay. This is a very valuable point in the use of such material, and the further we get to a standard throughout the country, the more valuable will be the use of our pressed steel forms. Another important feature in these trucks is their elasticity, which no other form possesses to such an extent. A frame having a high degree of elasticity cannot possibly destroy itself, as a rigid built one will. We cannot have action without reaction, and when a shock is imparted to a pressed steel truck, the blow is distributed uniformly throughout the frame, and, owing to the high elasticity of the whole, each part takes its own share, and thus relieves the jar. In a rigid frame, however, such a shock would naturally cause far greater deterioration than in the more elastic frame.

If the whole train is made up of such elastic trucks, it is capable, after receiving a shock, of giving it back again, and under such circumstances little or no harm is done. I have closely watched the effects of elasticity in our trucks moving round curves and over bad roads, and have been astonished at the ease with which they worked.

Wrought steel has worked a marked change in the construction of ships, bridges and the buildings we live in, and I trust I have so far succeeded in demonstrating that solid pressed steel is about to make a practical improvement in car construction.

Mr. Schroyer raised several objections to steel center plates.

Mr. John Mackenzie favored the steel center plate and considered that its superior strength would be an advantage.

Mr. Snow said that their center pin goes through the first bar of the transom, and then a cast iron collar is pressed on and held with a pin. This leaves the center pin loose and there is no breakage.

Mr. William Forsyth favored the use of pressed steel center plates and contended that Mr. Schroyer's impressions about them were not well founded. Considered that the greater part of the trouble to cars resulted from the sliding of car bodies on trucks, and he believed this trouble to be most prevalent with swing bolstered trucks.

Mr. Schroyer: The question of the utility of a swing motion and a rigid beam truck is not under discussion today. Certainly every road that has a swing motion truck has a reason for using it. I am very certain that we have. Less power is required to pull a train of cars with a swing motion truck than with a rigid truck. I think, though, it is harder on rails, on the curve, all of which are questions that must be considered in the use of any truck on a railroad; and that is a question which was duly considered before the swing motion truck was put into service on our road There was a time when we used the rigid truck, and it was discontinued for the use of the present swing motion truck. And while the original cost is greater, and probably the cost of maintaining is greater, it is so much better as to save expense somewhere else?

Mr. Verbryck: Mr. Schroyer has made some remarks about the center plate. Now, that form is the form of our cast iron center plate, and we are using a swing beam truck. We occasionally have a broken center pin, but I have never yet found that that form has been driven out from under; at least, if they have, I know nothing about it. If the objection had been as great as he speaks of, I do not see how it would not have been just the same with the cast-iron center pin. I do not believe much in this trouble that Mr. Schroyer refers to with broken center pins, because we do not have them—or rather, we have some of them, just as we have something of everything, but not enough to make any particular point about.

After some more discussion relating to the rough usage given to cars in switching the subject was closed.

Contract for Chilled Car Wheels

At the February meeting of the New England Railroad Club Mr. J. N. Lauder introduced the subject of "Form of Contract for Chilled Car Wheels." He related what had been done on this subject by the Master Car Builders' and Master Mechanics' Associations, and mentioned that last year the form of contract had been adopted by letter ballot. The wheel makers had displayed a live interest in the subject while the form of contract was under discussion, but since it was adopted by letter ballot they appeared to have lost interest in it. Believed that it would be to the advantage of railroad companies if purchasing agent and other officials concerned would be guided by the standard contract in ordering wheels. The Old Colony purchased their wheels on a service guarantee, and if they do not prove equal to the mileage new wheels have to be supplied and the maker gets no pay for the mileage made by a rejected wheel.

Mr. Lauder then read a paper written by Mr. W. W. Snow, of the Ramapo Wheel and Foundry Company, which was in part as follows:

"The changes in the specifications from those that were submitted by the conference committees composed of master car builders, master mechanics and wheel makers have been so slight that we will make no reference to them at this time. The changes made in the guarantee have been in some respects liberal, and the remarks of the committee as stated in the second paragraph, referring to the special purposes of this guarantee, are very satisfactory. We are certain that all wheel makers will appreciate the co-operation of railroad officials in assisting to raise the standard of chilled iron wheels.

We, however, regard the omission of wheels removed because of sharp flanges from the list of those for which the maker is *not* responsible as very severe; and we think there is apt to be much controversy over this point. A very large proportion of sharp flanges are due to other causes than the quality of the chill on the wheel. At a recent meeting of the Wheel Manufacturers' Association, the Master Car Builders' report was under consideration and it was recommended by that Association that where wheels are removed for sharp flanges the flange should be broken, and if the fracture shows a good bright chill, it shall be evidence that the flange wear was produced by other causes than those for which the wheel maker is responsible.

Referring to the proposed settlement, we would suggest that the form or table given on page 86 of the Master Car Builders' Annual Report is somewhat misleading. This table represents the comparative value of or difference between the high and low priced wheel. It is not a table by which settlements can be made, as it places no market value on the old wheel. To place the matter in its proper light, we would suggest a careful consideration of the relation of the scrap value of the wheel to the price of a new wheel. We find there ar two items of value in a wheel. One is the scrap value, which must be always recognized in the new wheel as well as the old; this value is always about 45 per cent. of the cost of the new wheel. The other item of value is the service of the wheel in miles or months.

To illustrate a settlement on this basis:

Cost of wheel	$10.00
Scrap value, 45 per cent.	4.50
Service value	$5.50

This service value—$5.50—is guaranteed to equal 60,000 miles in service performed. We therefore find the cost to the user to be $\frac{1}{10}$ of $5.50, or 9$\frac{1}{2}$ cents per 1,000 miles of service. It is quite evident that this 9$\frac{1}{2}$ cents per 1,000 miles of service should be the basis of settlement for a wheel costing $10, and the table, as presented in the report, should be adjusted to the facts as already shown.

The following table represents the scrap and service value, together with the proper contract rates for the settlement of mileage for wheels costing $11, 10, $9 and $8, respectively:

Cost of wheel	$11.00	$10.00	$9.00	$8.00
Scrap value, 45 per cent.	4.95	4.50	4.05	3.60
Service value, 55 per cent	6.05	5.50	4.95	4.40
Basis of settlement for short mileage under guarantee of 60,000 miles given in cents per 1,000 miles	10$\frac{1}{2}$	9$\frac{1}{2}$	8$\frac{1}{4}$	7$\frac{1}{8}$

The above table corresponds with the method of computing the cost of wheel service as suggested by the Wheel Makers' Association."

Mr. Lauder thought there would be no injustice done in purchasing wheels on the plan advocated by Mr. Snow.

Mr. Marden believed that the best wheel is the cheapest for railroad companies. Their company had adopted the standard contract and bought their wheels according to their provisions.

Mr. Shinn believed in calling upon makers to sustain their guarantee, but when a wheel ran beyond the mileage for which it was sold, he favored crediting the maker with the value of the extra mileage.

Mr. Curtis thought that, to make this system fair, makers should be charged with the expense of delay when a car had to be taken out of service owing to a defective wheel.

Mr. Lauder believed if the system of paying for mileage came into use that the wheel makers would produce wheels that would give more than their guaranteed mileage. If a wheel will make 20,000 miles in excess, the road simply pays for that, so there is no danger of their taking the wheel out, as there might be under the present system, to beat the wheel maker. I don't say that any railroad would do it, but under the present guarantee I have known railroads to steal the cars of other roads and paint them over and mark their names on them.

Mr. F. D. Adams (Boston and Albany): You needn't look at me; I didn't do it.

Mr. Lauder: I didn't suppose any railroad would do it; but the road that would paint other fellow's cars and put his name on them would probably do that. Under this system there is no object in doing that, because we simply pay for for what we get. We pay for all we get, and we do not pay more.

Mr. Curtis: I think there is no make of wheels for the Old Colony that, throwing aside slid wheels and cut flanges, will not average over 40,000 miles on passenger service. I will say also that wheel makers are not very liable to criticise what is returned to them. They will take whatever we will give them in the way of returned wheels.

Mr. Adams: While I am ready to agree with Mr. Lauder in the general character of the contract, I never looked upon it as being very likely to be followed out in detail by the parties purchasing wheels, and I am quite surprised to find even one road that it is doing it. I do not know but there may be a great many roads doing it, but the Fitchburg is the first road I have ever heard of as buying its wheels under this contract. I am not prepared to say that it is not the best thing that could be done. I presume it is as good as could be done, and think it would be perfectly fair to both parties, the makers and the railroads, if it could be done in that way. The purchasing agent wants to have his way in purchases, and he stands right in the path of the adoption of such a plan. I do not believe in the process of testing that is used on the wheels of the Pennsylvania. I would rather buy a wheel of a man whose wheels I knew were reliable, and take my chances and not test any of them. On our road we never test a wheel or axle, and yet I would venture to say you cannot bring forward a road in this country that has less broken wheels and axles than has the Boston & Albany.

Mr. S. D. Nye said he had been manufacturing cast-iron wheels for 32 years, and that manufacturers had grown utterly tired of the practice of returning wheels which had run 49,000 miles on a guarantee of 50,000 service. He thought manufacturers should be paid in such cases. He declared that the Old Colony and the Boston & Albany were using wheels that had made 70,000, 80,000, and even 95,000 miles, and were still in service.

Mr. Adams: For 16 years the Boston & Albany on its passenger cars has used nothing but steel wheels.

Mr. Nye: You are mistaken; I have furnished you cast iron wheels for your passenger cars within 16 years.

Mr. Adams: There has been no record of iron wheels used by us since this club was organized. Possibly we have given you a record of wheels that were used before at a certain time; but I know we were ordered by our president to take out all iron wheels before I came to Allston, and I have been here 12 years.

How the Horse-Power Unit was Established.

A valued correspondent writes us: "In a recent number of your journal you give some particulars of how Watt came to establish the weight of 33,000 pounds raised one foot per minute as the unit of a horse power. You say that Watt, in his usual careful way, ascertained what average work the horses in his district could perform, and found that the raising of 22,000 pounds one foot per minute was about the actual horse power, and that he added one-half to that, making the figures 33,000. That this was done and offered as an inducement for people to buy the engines built by his firm. I have heard that story before, but it is myth of the same character as the chestnut gravely told by Smiles that the attention of the boy James Watt was first directed to the potential power of steam by seeing the lid of his mother's kettle raised by the steam from the boiling water.

The true story of how Watt came to use 33,000 foot pounds as the horse-power unit is this: He found that a common speed made by a work horse in British cities was two and a half miles an hour, while pulling with a constant draft of 150 pounds. This you will find to be the equivalent of 33,000 foot pounds. On this basis he adopted the rate of 220 feet per minute as his piston speed, and each 150 pounds of pressure on the piston at this speed was reckoned as a horse power."

The version of the story given by our correspondent of how the horse-power unit came to be adopted may be correct, but we see no reason for believing it to be more authentic than the version which we gave. We are aware that Watt found the heavy Belgian horses used for hauling brewers' drays in London were capable of exerting a steady pull of 150 pounds while traveling at the rate of two and a half miles an hour, but that does not represent an ordinary horse power, and Watt was perfectly aware that 100 pounds was about the pull exerted by an ordinary horse, That gives 22,000 foot pounds as the real horse-power unit, and we see no reason for doubting that the increase was made to secure business, for with all his inventive genius Watt never failed to avail himself of opportunities for advancing his business interests.

The construction of elevated railroads in Chicago is being rapidly pushed, and the indications are that two lines will be in operation before the end of the year.

Methods of Strengthening Box Car Ends.

In regard to the different methods for strengthening the ends of cars illustrated in the annexed engravings, Mr. H. J. Small, superintendent motive power and machinery of the Southern Pacific Company writes us: This is a matter that we have given considerable attention to for some months past. As you know, all rolling stock on this system is equipped with the quick-acting Westinghouse automatic air brake, and for a considerable portion of the year a large item of our traffic is sacked grain from the interior to tide-water. The combination of the above has very forcibly shown us the want of strength in box car ends as ordinarily constructed; bulging ends is the rule, and in many cases broken posts and girths. I inclose a blue print showing several plans considered for strengthening box car ends, and we have built a few cars with ends like No. 2 and No. 4. You will notice that we have turned the post around so as to get the benefit of the full strength of the timber to resist force of shifting loads. In No. 2 you will notice that we have converted the lateral end rod into quite an effective truss, and have done the same with the vertical end rods.

In No. 4 we add another lateral truss rod with vertical rods trussed in same manner as in No. 2.

Nos. 3 and 5 carry the trussing idea still further, leaving the posts as now ordinarily placed, and carrying the truss rods outside the sheathing. This may be objectionable, and we will experiment with Nos. 2 and 4, fully expecting to get desired results.

As freight air brakes are now being generally discussed, with the probable result of their universal adoption, this box car end matter is a point that you might feel interested in taking up and discussing in your paper. Some one will, doubtless, suggest some better way of overcoming the difficulty.

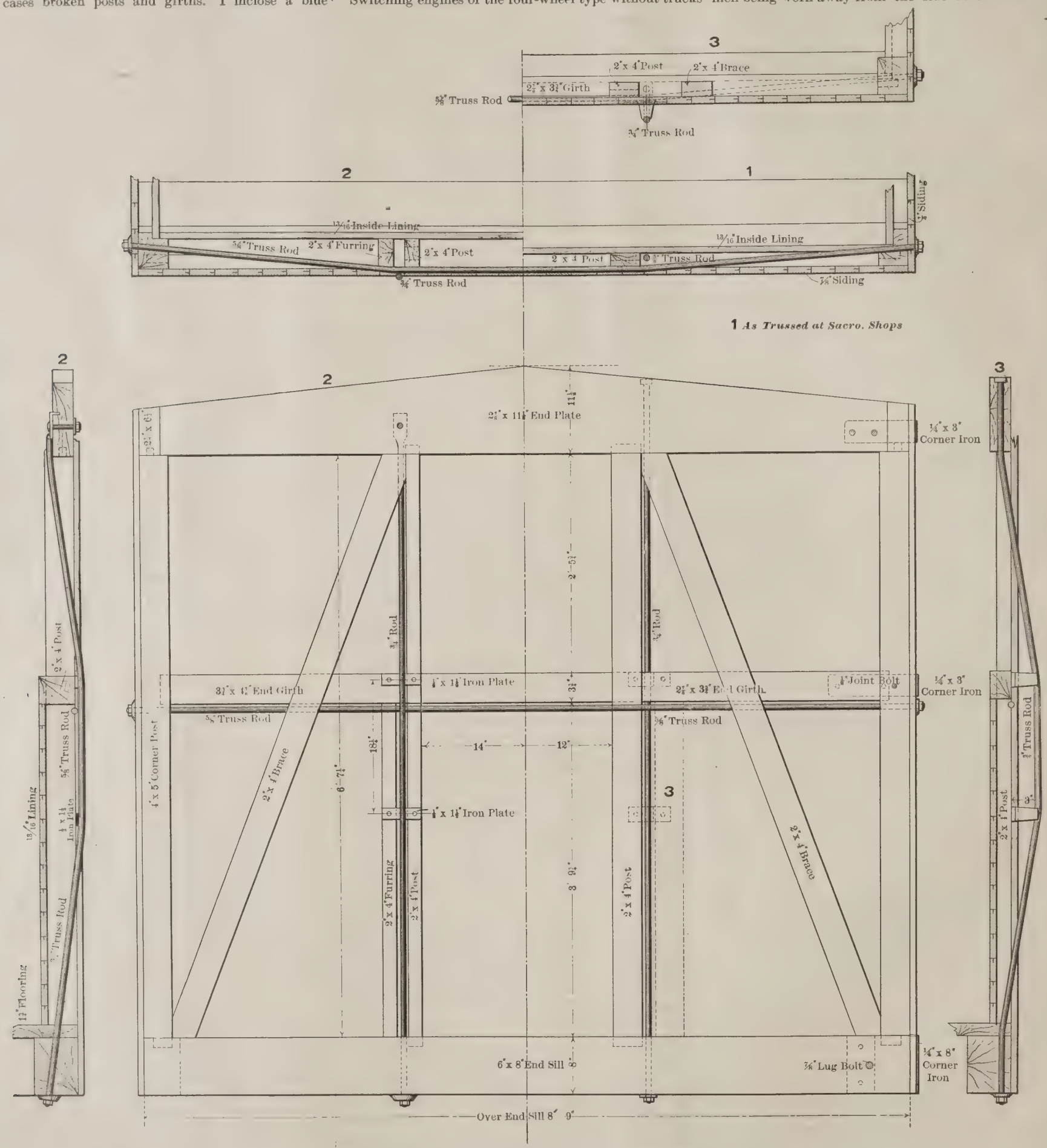
Effect of Flange Play.

A contribution from Dr. P. H. Dudley to the American Society of Civil Engineers contains the following information about flange play:

Switching engines of the four-wheel type without trucks to guide them, and having the usual flange play, usually wear the flanges of all the drivers. Reduce the amount of flange play to a quarter of an inch and the flange wear of the drivers is nearly checked. This was shown by lessening the flange play of the drivers of switching engines in the Grand Central yard previous to the year 1876, and it has since been continued. The flange play on the engines of the New York Central has also been lessened, the flange wear being decreased. The majority of drivers of passenger locomotives, with proper leading trucks, do not wear the flanges of the driving wheels sharp. Freight car trucks with short wheel bases and large flange play, have a much larger percentage of sharp flanges than passenger coaches with longer wheel bases.

The flange play of three-quarters of an inch and about one-quarter of an inch of journal play, is too much for a freight car truck, as it permits the outside of leading wheel flange of the truck to impinge on the rail forward of a perpendicular from the center of the wheel, and abrasion of wheel and rail takes place; the ratio increasing as the gauge widens by wear of wheel and rail. The axles, instead of running parallel to the radius of the curve, point forward of its center. If the wheel runs normal to the curve, the abrasion is slight and the lines can only be traced on the side of the head of the rail; if the short wheel base and flange play permit a large angle, the abrasion is faster, the lines become more distinct. On an outside rail on a sharp curve on heavy down grade, the abrasion is very severe and rapid, over five-sixteenths of an inch being worn away from the side of the head of the rail in nine months' service, the tonnage passing over the rail being 4,350,000 tons. The experience with perfect wheels, if any exist, is very limited. Under my own car, wheels with perfect cylindrical treads of exactly the same diameter upon the same axle, in a four-wheel truck, seven-foot wheel base, have run over 1,000 miles without showing any tendency to sharp flanges.

In the six-wheel truck, 11-foot wheel base, the two outside pairs of wheels have only a quarter of an inch play between the flanges and rails; these have run 70,000 miles; the flanges are worn, but are not sharp. The limited amount of play in this long truck was not to prevent flange wear but to check the oscillation of the truck. Flange wear causes train resistance, consequently increased coal consumption.



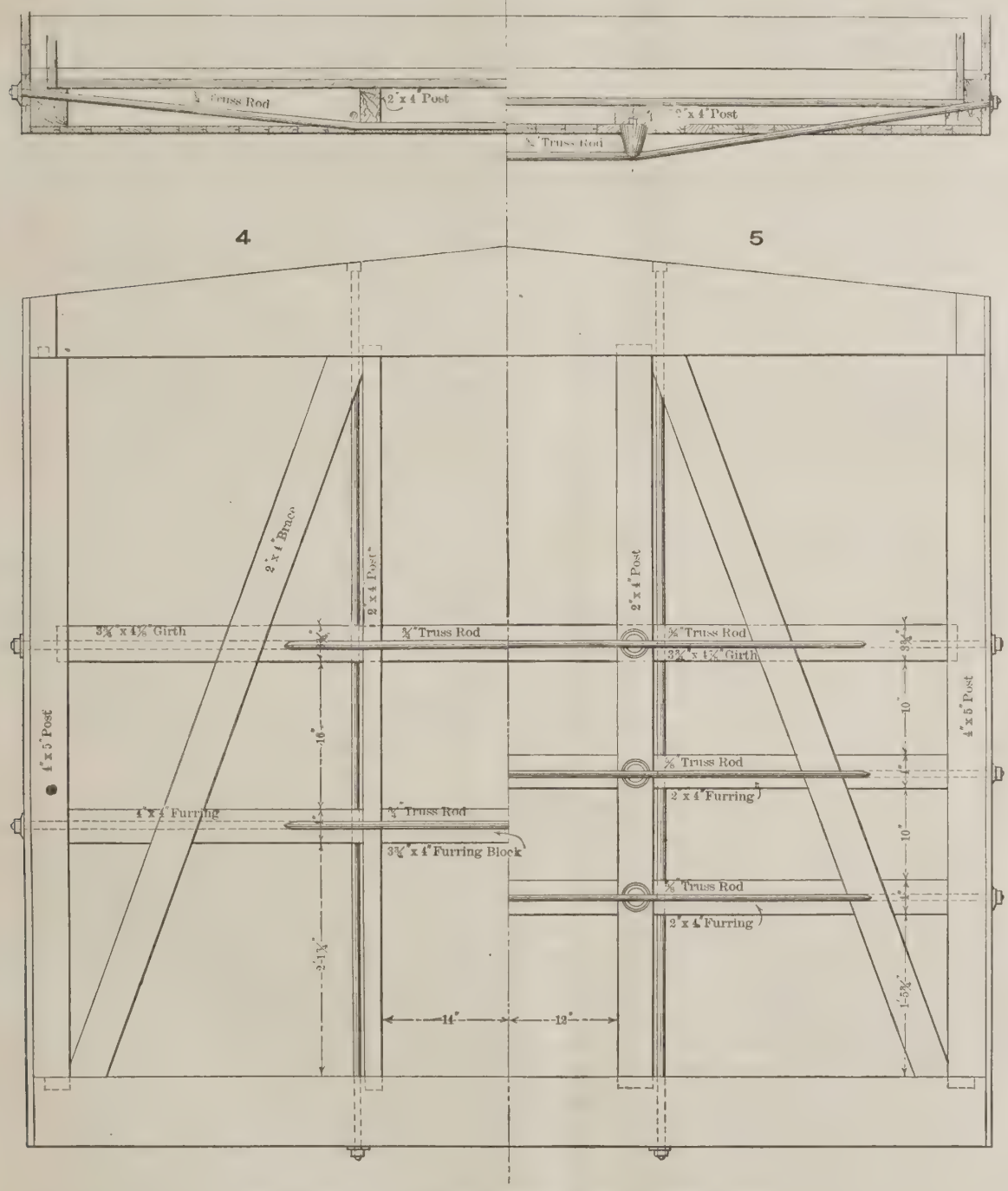
METHODS OF STRENGTHENING BOX CAR ENDS.

Working Irregular Shapes in Planing Mills.

In planing mill operations success very often depends upon the use of machines specially designed for the work to be done. But even with the best of machines it is highly important that the greatest care should be bestowed upon the design and adjustment of cutters suitable for the shapes to be produced. The cutters and peculiarly shaped tools not only need to be kept sharp but they ought to be so formed that as much as possible of the cutting edge shall be doing the same kind of work. In working a plain surface all that is required is that the knives be sharp and straight and set so that each one of the set may perform its part of the work, and as each part of the edge is presented to the work at the same cutting angle, there is no difficulty in keeping them in perfect shape, as the wear is uniform. But with moldings and all other irregular shapes, such is not the case, and in many instances not any two places in the whole width of the cutter are presented to the work at the same cutting angle. Consequently the wear is unequal and those parts that are presented to the work at the most favorable angle will perform their part of the work easier and retain their shape longer, while other parts that are not presented to the work at the same angle, but are obliged to remove the surplus material by a scraping out action, then lay the cutter upon it with the face down, the sides resting against the turned-up edge of the tin, then with a fine sharp scratch a perfect outline of the edge may be delineated so that, by laying it upon this tin plate in the same position at any future time when grinding or filing, the slightest variation in the shape may be detected.

Drawings for the exact shape of moldings are frequently sent, but it requires considerable skill to form the cutters so as to correspond to them. There are rules for designing and laying out the shape so as to get the proper projection upon the cutters, but these rules are somewhat complicated and require about the same time to make the proper shaped drawing for the cutters. The simplest and most practical manner is to work out a short piece, to the exact shape of the drawing, by hand, then place it in a miter box, the underside pressed against the side of the box, and cut a small piece from the end. This will be at an angle of forty-five degrees from the underside and the face of this cut, although differing materially from the shape of the molding, will, nevertheless, be the exact shape required for the cutter.

The question of a hard or soft temper for cutters of this kind has been often discussed; but from extensive observation and practical experience it is now generally conceded, by a majority of first-class operators, that there is no advantage in cutters of any kind with a high temper, and that



METHODS OF STRENGTHENING BOX CAR ENDS.

offer much more resistance, and are worn away and become dull much sooner. Unless especial care is manifested in sharpening such cutters, they will soon lose their shape and materially alter the shape of the molding. Under such conditions it frequently becomes necessary to grind or file off one portion of the cutter more than would otherwise be necessary in order to compensate for those other parts that have been worn away more rapidly. For instance, let a knife be fitted so as to form a perfect half-round piece ; it will invariably be the case that, while the cutting portion at the center or highest point of the piece will retain a good cutting edge, that portion of the cutter projecting along the sides and extending toward the table will, by the scraping manner in which it is presented to the work, wear away and become dull much sooner. If, in sharpening, only those parts which have become dull were touched, in a very short time the sides, by wearing away so much faster, would soon change the shape from a half-round to a flat oval. Especial care should be manifested in grinding or filing to take off the same amount from every other part of the cutter in order to preserve its shape.

A standard pattern should always be kept on hand to test the shape of all irregular shaped cutters whenever they are filed or ground. If the molding or other irregular shape is a standard one, and liable to be often called for, about the simplest and least expensive gauge may be formed out of a piece of tin. When the cutter is first finished and tested as to the proper shape before it is used, take a new piece of tin, turn up one edge square, about one-eighth of an inch high, cutters of medium temper, so that they may be cut with a sharp, fine file, are less liable to break and at the same time will retain a good cutting edge longer than those that are either very hard or very soft.

Experiments with different cutters have proved that where two cutters are placed upon the same machine, one very hard, while the other may be of a medium temper, after running one hour, if the edge of both be examined with a magnifying glass, both will present the same rounded appearance of all rotary cutters, and this may be accounted for upon the theory that with the hard one that fine thin edge crumbles off, while with the other it is gradually worn off, so that, as before stated, their conditions after being used a short time are practically the same, and as the cutters of medium temper are much easier kept in order than those which are very hard, the advantages seem to be in favor of cutters of medium temper.

Sectional cutters for special odd jobs may be used to good advantage many times when the proper shaped cutters may not be on hand, as the shape may be varied with the same tools so as to form several different styles of moldings; but when sectional tools are thus used they should always be in pairs and balanced with each other, so that when placed upon the head opposite to each other, they will form a perfect running balance. But the practice of using only one knife of each shape, or using one full knife balanced by a piece of iron, as is the case in some mills, should never be tolerated, for, as it is impossible to obtain a correct running balance under such conditions, the damage to the machine in a very short time will be more than would pay the cost of special cutters fitted up in pairs and well balanced.—*C. R. Tompkins in Age of Steel.*

Sleeping Cars Impover sh Railroad Companies.

In the third annual report the Interstate Commerce Commissioners publish investigations into a great many practices that are injurious to the interests of railroad companies. Among other things, the car mileage paid for the use of sleeping cars is ventilated. On this subject the report says :

Another illustration of the workings of a high rate of car mileage is furnished by the Pullman palace cars and similar cars so generally in use by the railroads of the country. The rate paid for these cars is three cents a mile. On a route, for example, like that between Washington and New York, of 230 miles, the mileage for one car for a round trip, that may be supposed to be made in 24 hours, is $13.80; for a month, $414, and for a year, $4,968. These extensions may not be exact as to actual results, but will serve for illustration. The profits to these private car companies are shown by the report of the Pullman Company for the year ending July 31, 1888. The capital stock was reported at $19,872,900; the gross earnings, exclusive of income from patents and other sources, at $6,259,376.97; the net earnings at $3,957,771.87, or 20 per cent. on the capital, and there was an accumulated surplus of $12,552,393.

This presents a striking contrast to the profits of the railroads of the country as a whole, or even to the balance sheets of the best railroad properties. It is obvious that very reasonable profits would remain to the Pullman Company, and a heavy drain upon the treasury of the railroads be averted by a material reduction in the mileage rates for these cars.

Besides, the use of these cars is an excuse for furnishing inferior passenger coaches by the roads. The traveling public are burdened with high rates for transportation in these cars, or subjected to inferior accommodations in ordinary coaches. If any portion of the public desires to pay higher rates for special accommodations, there can be no objection to their doing so, but the provision for the superior accommodations should not become a charge upon the general transportation. In England, where different classes of passenger cars are furnished, striking results have been produced by the provision of suitable cars of the third class. That class of cars has of late absorbed the bulk of the travel, and furnished the revenue to the roads from their passenger business, while the first and second-class cars, with the superior accommodations, have become a tax upon the other business.

Seniority in Promoting Firemen.

As a rule, railroad corporations want men of unquestioned competency to fill every department, and in no department is the requirement of greater concern than in the moving of trains.

Railroad officials study their employés with special reference to promotion, because responsibilities increase with every advancement, and it is at this point that merit assumes special prominence. It is also at this point that the claims of seniority are supposed to have preponderating weight. It may be said, in the way of illustration, that a railroad official who has the appointing power wants an engineer, and that the policy of the road is to promote firemen. Suppose there are twenty firemen on the road, that five have been in the employment of the road three years, five four years, five five years, and five six years. The five who have been in the employ of the road six years are the seniors of the other fifteen, hence the claim that one of their number should be promoted. Manifestly, all things being equal, there can be urged no good reason why any one in the ranks below six years' service should be promoted over the seniors. Under such circumstances to disregard seniority smacks of rank injustice. It demoralizes the entire force. It is the worst thing that the official could do. It is suggestive of unworthy motives. It is a crushing blow aimed at honorable ambition. Firemen say, and are justified in saying, that the promotion was secured by dishonorable means ; that the official had been influenced by considerations of the most vicious character, involving the manhood of the man promoted.

That is one side of the case. But there is another side of the subject of still greater gravity. In the case under discussion seniority may mean nothing but mere years in the employment of the road—merely a question of time. The man who has been a fireman six years is the senior employé of the man who has worked only five years, and so on down. When the time comes for promotion there should be, and there will be, other questions asked besides those which relate to years. It is right and proper that such should be the case, and the fireman who has been watchful, studious, honorably ambitious to succeed in his chosen calling, who has husbanded his time and his money, and who has established his reputation for intelligence, though he may have served but five years, or four years, or, indeed, three years, may be better equipped for the position of engineer than the man who has served six years, and has neglected his opportunities to improve his mind and add to his store of knowledge, and we hold that, under such circumstances, merit, and not seniority, should influence promotion.

If men aspiring to promotion are unable to comprehend the value of equipment in its largest and best sense, and rely solely upon seniority for advancement, they should be taught that something more is required, and this lesson they are likely to learn to their great disadvantage.

Taking a broad view of the subject, we come to the conclusion that seniority may be justly urged as a prior claim to promotion when qualifications are superior or equal in all regards to those of aspirants who have a less number of years of service to their credit.—*Locomotive Fireman's Magazine.*

Communications.

The Double Card System.

Editor National Car and Locomotive Builder:

It is about the usual time for the annual dissection of the rules of interchange by the different railway clubs.

The Central Railway Club, of Buffalo, have gone into the rules pretty deep already—in fact, so deep that they could not extricate themselves at their last meeting. The proposed revision of Rules No. 5 and 6 that was presented by their committee on that subject, was like a bomb-shell burst in the camp, it created such a racket. The subject was continued to the March meeting with an addition of four to the committee, making nine, the following roads being represented on the committee: Grand Trunk, Lehigh Valley, West Shore, Michigan Central, Lake Shore & Fall Brook. The principal question at issue is, shall there be a *two-card* system, or not? The original committee recommended in their report two cards, one a white card for new defects, the other a red card for old defects. That there is a need for something of this sort is quite evident: first, to give better protection to roads handling foreign cars with old defects; second, to cause owners to either see that their cars are in good order before leaving home, or if they have old defects that may not at the time be unsafe to run, to compel them to put on an "old defect" or red card before acceptance by the receiving road. The object would then be obtained, which has not been under the present white card system.

It has been stated by experienced car masters that the red card will exclude the white one entirely. Those that have proposed the white and red card system do not think so, because the number of cars found away from home with old defects is about equal to the number with new defects; therefore the road that is caught with a foreign car having old defects will have the privilege of attaching the red card, which will make the owner responsible. The result will be that the road that has been in the habit of letting their defective cars out under load, will have their eyes opened to the fact that it is cheaper to put their cars in good order, or "red card" them, before letting them go from home. The white, or new, defect card will be used just as much as before, but in a more legitimate way. It will be used on all cars that are found with new defects, thus making the road causing the defect responsible for it.

It is claimed by some that the red card will be used to cover the new defects in order to shirk responsibility. Admitting that the red card may sometimes be used illegally at first, but how long will it be until the dishonest men are caught, which would not be a very enviable position to be in. This same objection was made when the present one-card system was advocated, that it would be abused and that all the cars in the country would be running covered with defect cards. How is it now? The defect card became at once a great protection to the car department and at the same time gave better dispatch to freight.

The demand for more promptness in the delivery and interchange of freight is quite obvious. Detention to freight is of too frequent occurrence at junction points, and the car departments are getting the blame for it, and not without some cause. A large amount of these disputes arise from a disposition of delivering road to shirk the responsibility of old defects, claiming—and rightly, too—that they are not responsible, refusing to "pass card" the car, resulting in a transfer of the load. Four or five years ago some of the roads cross-printed on the M. C. B. defect cards, "This is not an order to repair," with good results, as it gave dispatch to the freight and relieved the delivering road from the responsibility of the defect which it did not make. But this did not last long, the roads that were flooding the country with their old defective cars began to squeal, and to some effect, too, as shown by the insertion of a clause in the rules prohibiting any change in the rules, as laid down at the annual meetings, which effectually, but not justly, shut out the "no order to repair" scheme.

At the present time there is a demand for better protection from defective cars and more dispatch in the movement of freight. To such a degree has this demand been made and not obtained, that in some railway centers the managers have threatened to take the matter up in another way, if the heads of the car departments don't get a move on. It is to be hoped that the M. C. Bs. don't want a repetition of the prodding they got before a decisive action was taken on the automatic coupler question.

To illustrate how the "two card system" can be worked to advantage, suppose a case of every day occurrence. A road offers a foreign car to B road with an old defect, but at present safe to run; B refuses to take the car without a pass card. A, not being responsible for origin of the defect, refuses to be made liable for it by applying a white card. Now, if the red card was legal he could apply it, thereby making the owner responsible, and rightly too, for the defect in case car failed, caused by the defect while on B's road. If the car is refused by B, because of a new defect, then A, being capable of discerning between an *old* and *new* defect, would apply a white or new defect card, thereby making his road liable for the cost of defect when repaired. Cases of this sort are occurring every day, and the delay to freight is getting serious. The next thing that happens, lightning will strike all along the line in a manner that will not do the Master Car Builders any credit.

At joint inspection points is where the two card system will work the most satisfactorily, as the joint inspector will be the proper party to decide between old and new defects. At most junction stations the joint inspector only is authorized to sign M. C. B. defect cards on interchange cars. Many junction stations use a "check and notation" plan to pass defects. This is very unsatisfactory for the "long haul" class of business; it is only suited to traffic at terminals that is to be placed on private tracks, &c. In the "long haul" case the check and notation is only good for the station where it is used; and if the car has to pass many junction stations it will be pretty well covered with "checks." Then, if it is reloaded back by another route, what good are the checks and notations?

The white card for new defects, and red card for old defects, will be good at any and all times, routes, and stations, that come under the M. C. B. rules.

The February "Equipment Guide" calls attention to the inspection of cars at interchange points as a very troublesome feature of the service. Sixty per cent. of these disputes arise from disagreements as to the responsibility for old and new defects, and because there is no rule to cover these disputes directly. The two card system will most effectually deal with the trouble and relieve the strain complained of. Finally, the "Equipment Guide" indicates that the Arbitration Committee of the M. C. B. Association is the panacea to heal all these wounds. In what manner, it is hard to discover; as the Arbitration Committee cannot deal with the dispute at the time, it is hardly possible for them to take any action that will give the desired immediate relief. The only assistance they can be is in their recommendations to the M. C. B. Association in the annual revision of the rules. It is to be hoped that they will this year recommend a white and red card system, which is the surest cure. The article referred to goes to show that continual delays to freight at interchange points, caused by the quibblings and disputes between inspectors, is being noted by those high in authority, and they are beginning to demand a reform.

PROGRESSIONIST.

Suppressing Club Proceedings.

Editor National Car and Locomotive Builder:

In the February number of your paper I see a rather lengthy letter, signed "Chicago," in regard to publishing the proceedings of the Western Railway Club, and in which, I think, the writer shows either very narrow-mindedness or is prompted by some selfish motives to hide from the world, and especially from thousands of railway employés equally interested in the progress of railway appliances, facts which we, as American citizens, are justly entitled to know. It looks as if he wants to hatch some scheme in the dark to be sprung upon the unsuspecting railway companies and the general public. "Chicago" must understand that all who are interested in the development and advancement of the railway business do not belong to railway clubs, and there are thousands of others equally interested whose main chance of enlightenment is through the columns of the journal. He who from fear of a little public criticism will shirk duty is not worthy the title of representative of railway enterprise. The same can be said of him who will take offense at a brother member who may express some more worthy ideas in opposition to his own.

As for the new members, I think the sooner they understand that they must express themselves before the public the sooner they will become desirable members, and for the master car builder who has been instructed to try a certain style of oil box that is represented to save 20 per cent. in oil, if, after he has given them a thorough test, he cannot see any saving in oil and does not give the facts in the case, he is neglecting his duty.

"Chicago" thinks that railway clubs should be a training school for railroad men to learn to express their thoughts in public, but I cannot see how talking behind closed doors is going to help them; and while the wisdom that drops from the lips of our friend "Chicago" at club meetings may be familiar to every train boy, there are men who belong to those clubs whose ideas and intelligence when imparted to the thousands of railway employés throughout this great country of ours do a vast amount of good both to the men and their employers. I do not express my sentiments here alone, but have discussed the matter with different railway men from the official down to the laborer, and they all say to publish club proceedings, and give us a chance to know what is going on.

MINNEAPOLIS INSPECTOR.

Editor National Car and Locomotive Builder:

Under the somewhat vague signature "Chicago," there appears a letter in this month's number headed "Publishing Club Proceedings." The author of that letter, as I see it, forgets the fact that there are many men connected with railroading who but for those published proceedings would remain in the dark. Now, sir, while I would not doubt the veracity of one single member of that distinguished body of gentlemen, I am a little inclined to ask "Chicago" what he is afraid of? Has he some particular hobby that he wants thrown upon the market in disguise, or is he afraid to let people in general learn something? It has been my privilege to know many of the members of that club as superior officers, in different capacities, and, in several cases, in different climes. Knowing this, then, you will pardon me if I tell you that I am disgusted with the conclusions "Chicago" arrives at. Such narrow-mindedness one would have to ransack the pages of history away back to find a parallel for. I claim that it would be shutting out from view the best interests of railroad employés, were those discussions, fraught with so much interest and practical knowledge, conducted with closed doors.

It is not the first time many among us have watched with regret "proceedings" hatched in a ring and sprung upon the public at a time "convenient for some selfish ends" that have done much to "clog the wheels of progress" and harass the best interests of many railroad companies, to say nothing of the general well-being and upbuilding of the country at large. Those of us who follow railroading as a calling, however humble, look upon this club proceedings as the very essence of our service, as we thereby gain an intelligent interest in the proceedings, which in any well-ordered mind will be used to the advantage of all concerned, not to speak of a personal ambition, gathered from a personal acquaintance, through virtue of those open proceedings, which we claim is the undeniable right of any one, young or old, rich or poor, who lives under the furl of the Stars and Stripes. Far distant be the day when such a thing as a body of men like those in attendance at the meetings of the Western Railway Club will come down to a platform so low as they are asked by "Chicago" to establish. The time has gone by, if, indeed, ever that time was, in this great America when the leaders of progress thought it would be better to hide those things from any but theselves. Such reasoning must be placed away back a full decade even in the Old Country. Better far keep on the good old way. The more knowledge you can impart even to your dog, then certainly the better service you will get. For the following three prominent reasons, I have pleasure in forwarding this, viz.:

1st. I have had many superior officers, of not one of whom it could be said but that he wished the best service possible.

2d. And they have all agreed that the more workingmen knew and interested themselves the better for them as officers and also the company's interests. Last, not least, so that some more powerful men may take a hold of this interesting subject before the enemy of progress gets the door closed.

CHAS. RIACH,
Car Foreman.

BARNESVILLE, Minn.

Car Ventilation.

Editor National Car and Locomotive Builder:

Will you allow me a little space to make a brief rejoinder to some parts of your editorial on my paper concerning car ventilation read before the Western Railway Club? My remarks as to the ventilation of cars when stationary by open doors and windows seems to have been totally misapprehended. It is a well known fact that sleeping cars often come into stations at four or five o'clock in the morning and the passengers remain in them until seven, perhaps. Power ventilation then ceases and some other means must be employed for the time being. Again, cars are often in stations receiving passengers at nine or ten o'clock and do not start out until some hours later. Above all things, it must not be forgotten that we live in a country where the thermometer ranges from zero and below to 90 and above.

The ventilating appliances need to cover a wide range to be a success, and it would be a little severe to run a loaded sleeping-car into a station with the mercury between 80 or 90, and leave it standing there with doors and clear story windows closed even for a single hour. Now, one word more about the cranks and differences of opinion as to ventilation, heat, etc. The very thing that causes all the differences is the ill-digested and poorly-managed contrivances that now prevail so extensively. In answer to this, let me cite a few facts.

The first car that was fitted up with a system of ventilation on the lines shadowed forth in my paper, had for its conductor an intelligent New England man, who had seen sixteen years' service in his place. He remarked to me one day, after the car had run three months: "This is the best ventilated car in the Union. It is absolutely perfect; I can keep the temperature at 70 without the least trouble. The passengers sit here as comfortable as in their own homes. There is no talk about opening this ventilator or closing that—no talk about cold drafts or too much heat—everything goes as smoothly as possible. We do not need to close the ventilators in going through tunnels to keep out the smoke, in fact we scarcely touch them at all unless we find the temperature falling." Above I have quoted the exact language used by a man of experience and intelligence, and I think it a fair answer to your remarks concerning the cranks, etc. Now I do not believe that cars will ever be built without some kind of ventilating apparatus, and I do believe that the method that will accom-

plish the purpose by the simplest means will be successful in the end.

The very way to abolish the continual annoyance of passengers demanding that this or that clear story sash be opened or closed is to substitute a ventilator that obviates the opening or closing of the sashes when the train is in motion—one that provides an abundant inlet and outlet of air without cold drafts, smoke, or cinders. That done the question is settled.

W. G. CREAMER.

Ash Pans and Dampers.

Editor National Car and Locomotive Builder:

I have often wondered why more attention is not given to fit locomotives with proper ash pans and dampers on many roads. We hear much about the necessity of economy in the operating of locomotives; therefore carefully constructed ash pans and properly fitted dampers that could be easily opened and closed when necessary would be in the line of economy by reducing the fuel bills.

It is true, however, that no matter how perfectly these appliances may work on a locomotive, no fuel saving will result unless the engineer, fireman and hostlers give the matter a little of their attention. On many roads the amount of fuel annually wasted is enormous; oftentimes considerable fuel might be saved without in the least increasing the duties of those in charge.

While engines are standing at stations or elsewhere, dampers are often convenient and necessary to prevent the escape of steam at pop valve, also to close off draft while descending grades and prevent useless coal consumption. But aside from all this, there is a still more important reason why care should be taken to have ash pans tight and proper dampers. When a locomotive is moving along there is an in-rush of air to ash pan, and if the air cannot escape at sides or opposite end of pan, much of it will be forced up through fire and will greatly assist in keeping up steam; especially is this true on fast runs, where the air can exert considerable pressure in ash pan. This air pressure makes a very considerable difference in the steaming of a locomotive on a fast run.

PITTSBURGH, Pa., Feb. 3, 1890. J J. CLAIR.

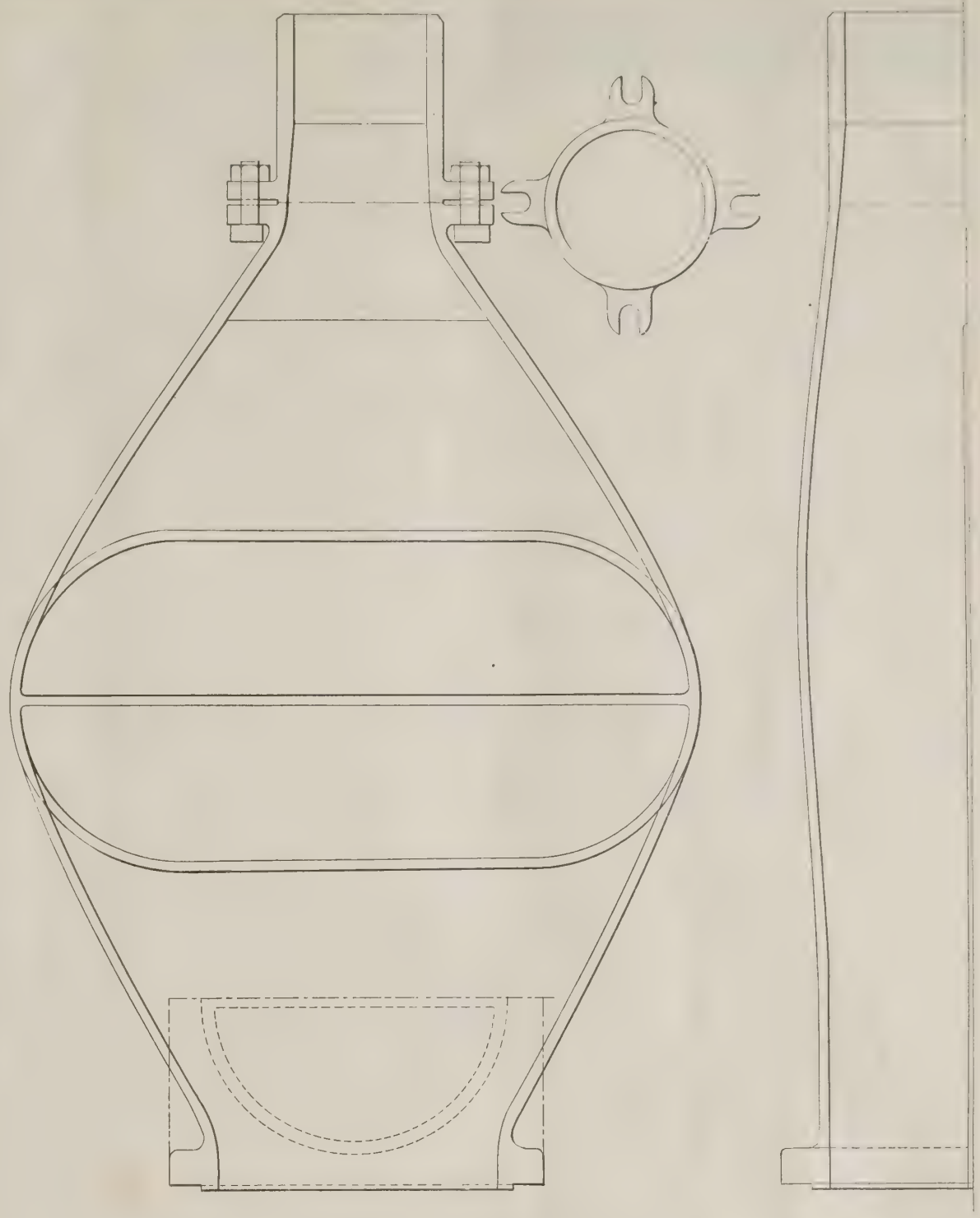
West Shore Buffet Cars.

The West Shore Railroad has made arrangements with the Wagner Palace Car Company to have placed in service on its road some of the finest buffet sleeping cars that the master car builders' art could devise. All of these cars will be built at the works of the Wagner Company, at Buffalo, N. Y.

The first one of these cars was placed in service last month, and left Weehawken on the fast Toronto through line, the West Shore being the only road that runs through sleeping cars between these points without change.

The finest kind of velvet carpet, of elegant and unique pattern, covers the floor, and the upholstery, which is heavy and substantial, has been selected with good taste from the best materials manufactured. The inside woodwork is of light mahogany, which gives a bright and airy appearance to the interior of the car. The car is divided into ten sections, a smoking-room, state-room and buffet, also private rooms for ladies and gentlemen. A feature which adds greatly to the comfort of travelers is that the seats have been made with high backs, and that each section has been provided with a portable table for use in serving buffet lunches. Each section has an electric bell and a lamp. The contrast between the solid mahogany and the metal work is very pleasing, the latter being heavily plated with nickel. In fact, all the metal work is nickel-plated, excepting the lamps, which are made of polished brass. The large number of these throughout the cars make a very cheerful illumination and afford a chance to read without straining the eyes. One of the innovations of modern car building characterizes the state-room, which has been provided with an annex, containing toilet and wash stands for the exclusive use of the state-room's occupants. The buffet, which rarely is allowed a sufficient amount of space, has in this car been built much larger and is located next to the smoking-room. An oval beveiled-edge glass extending from the floor to the ceiling separates it from the main body of the car, from which a view can be had of the seemingly endless quantity of decorated china within. Smoking rooms in sleeping cars are generally provided with two settees opposite each other. In this car the smoking room is unusually large, and is furnished with easy chairs, tête-à-tête and single, which are upholstered in plush. This car has the vestibule attachment, and is heated by steam. Hot and cold water is used throughout. The other cars, which will be equipped as luxuriously as this one and vestibuled, are expected almost any day, and will be used in the through service between New York and Toronto.

The employés of the Central of New Jersey are considerably excited over the reported intention of the company to introduce an insurance sick fund scheme. These beneficiary schemes are not greatly relished by the average railroad man in this country. He likes to form the scheme for his own benefit.



RESERVOIR EXHAUST PIPE.

The annexed engraving illustrates a form of exhaust pipe in use on engines belonging to the Kansas City, Fort Scott & Gulf Railroad. The notable feature about the pipe is the large size which acts as a relief chamber to the cylinders. The size that is most in favor has a cross section in the middle 3½ times the area of the exhaust nozzle. The officers of the road are very modest in their claims for the pipe, but they are certain that it causes a more uniform action of the exhaust on the fire and enables the engines to work much more freely than those having the ordinary exhaust pipe. Its use also enables them to use a larger exhaust nozzle.

Work of the Railroad Chemist.

The chemist having been secured, one of the first things that is usually given him is to explain some peculiarity that has been observed in the service. The first work done after the laboratory of the Pennsylvania Railroad was established was to make an investigation into the reason why the valves and steam cylinders corroded so badly. The ordinary life of a valve was about a year, and whenever an engine came in for repairs, there was always more or less corrosion about the seat where the steam chest rests on the cylinder. A careful study was made of the conditions, and the conclusion reached was that the difficulty was due principally to the acids in the tallow used for lubricant, and that corrosion was assisted by the sponginess of the castings in the valves, since the cavities in the castings afforded places for the lodgment of the tallow At the time this investigation was started no record could be found in the literature of the case to show that the fat acids characteristic of tallow would corrode iron at the temperature of steam cylinders, and direct experiments were made with these acids demonstrating this point. The explanation of the difficulty having been obtained, of course attention was directed toward securing a mitigation of the trouble.

As another illustration of the application of chemistry to bad results obtained in service, the following may be cited: One of the special cars, after having been cleaned by the car cleaners, was noticed to look badly, and on examination by the foreman of painters it was declared that the varnish had nearly all been removed by the cleaning. As a matter of discipline, the foreman car-cleaner was asked to explain why the varnish had been so badly used, and he claimed he could do no better with the soap he had. A sample of the soap used was submitted to the chemist, who found not less than three per cent. of caustic soda and seven per cent. of carbonate of soda, in addition to the soda combined with the fat as a legitimate soap. This, of course, explained the peculiarity and justified the foreman, as the soap solution used in washing the car was in reality a concentrated solution of sal soda and lye, which readily dissolves varnish.

Another field for the activity of the chemist of a railroad is to protect against fraud. Not a few cases could be cited, showing attempts to sell at excessive prices, under some special name, common articles, which can be obtained in the market at very low figures. One of the most common of these attempts is that of selling some cheap materials for use as anti-incrustating boiler compounds. y m aterial has been offered at 25 cents per pound, which on examination has been found to be nothing but sawdust and sal soda. Again, boiler compounds have been offered at 50 cents per gallon, which have been found to be apparently spent tan liquor, containing a little sal soda, 95 per cent. of the material being water simply.

Another example in this line will make the matter still more clear. Some four or five years ago investigations were made in the laboratory of the Pennsylvania Railroad, on the composition of the oil burned in the hand lanterns and elsewhere, and known in railroad language as signal oil. This oil, as is doubtless well known, is a mixed oil, the principal constituents being either lard, colza, or mustard-seed oil, together with varying proportions of petroleum distillate, known in the market as 330 degree fire-test oil. The question to be decided was, what mixtures of these various oils will give satisfactory results at the least possible cost? To solve this problem, analyses of various mixtures of signal oil obtainable in the market were made, and then new mixtures were made in various proportions of the oils mentioned above, which were subjected to burning tests. As a result of the whole work, which extended over a period of a month or two, a formula was developed which gave an oil that was perfectly satisfactory by all tests, and at the same time produced a saving at the prices then prevalent of about ten cents per gallon over the practice then in use. Oil was made according to this formula, and distributed to the men without their knowledge that any change had been made; and quite to the gratification of those authorizing the change, and somewhat to their astonishment, no increase of complaints in regard to oil could be observed. The economy in operating expenses produced by this change amounted to about $15,000 per year.—*Dr. Dudley and F. N. Pease in Railroad and Engineering Journal.*

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

MARCH, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Economy of Engine Oil.

No one is likely to find fault with railroad officers for trying to keep down to the lowest possible limit the quantity of supplies used in the operating of machinery, but it is very easy by injudicious demand for saving to bring about much greater loss than the reputed saving amounts to. In no instance is this more likely to happen than in putting severe pressure upon engineers to run the locomotives with the least possible consumption of oil. We are aware that many enginemen are in the habit of pouring oil on and at the bearings, as if the lubricant was as cheap as the water taken into the tank, and it is right and proper that this careless habit should be checked, but it is very easy making an engineer zealous in the other direction, and when that happens the engine is likely to suffer for want of the lubrication necessary to make the rubbing parts run freely. Two years ago an interesting and edifying discussion took place in the Master Mechanics' Convention on the quantity of oil necessary for cylinder lubrication, and some very sensible remarks were made about the practice of restricting the quantity of oil to the lowest possible limit. The tendency, however, was to recommend running with the least possible supply, and we are afraid that the emulation engendered is not working for the benefit of railroad companies. We have several times within the last six months heard of railroad companies having trouble with their cylinder castings, and in every case there was the best reason for believing that the source of the cutting complained of was the lack of oil. A good casting does not require much lubricating to keep it running nicely where water is kept out of the cylinder, but the best of castings will fail as badly as poor ones when the engineer permits them to run dry.

The practice of interesting enginemen in fuel and oil saving by allowing them premiums on the economical use of their supplies appears to be spreading, and those concerned say that it is an excellent plan for reducing operating expenses. In the case of fuel we believe that premiums work well, but with oil the case is different. A master mechanic who attends to his business will very quickly find out the men who habitually waste oil, and a little discipline will restrain the practice. It is better for the machinery and for the coal consumption that a little more rather than a little less than enough oil should be used and a small amount of waste is not a severe drain upon the finances of the company. Where the attempt is made to keep the oil supply below the requirements, or where the engineer is given encouragement to scrimp the quantity passed through the cuts there is certain to be loss of power due to the increase of friction, and delays from heating that result from want of oil. There is another reason why saving of oil should not be given a premium. In train service, oil has to be used very freely on cars, and the supply for this purpose is easily reached by enginemen. It is just as well not to make them so much interested in oil that unscrupulous men will divert the lubricants from the cars to the locomotive bearings.

The only oils that there is any inducement for using sparingly is the high-priced cylinder oils, and in that case it is the very worst policy to make the supply less than what is needed. The proper way to economize on cylinder oil is to use sight lubricators that will measure out the oil as it is required. When these are employed and a fair supply of oil passed through them, the rubbing surfaces will be kept lubricated with the least possible expense and the deduction in friction will make the engine much more efficient. The practice of oiling the valve and cylinders at intervals when the steam is shut off is one of the most persistent ways of spending constantly to save a little outlay in first cost of apparatus. A serious mistake, however, often made by those who have introduced the use of sight lubricators is the assumption that the improved method of oiling will save the greater portion of the oil previously used. A sight feed cup that works properly will generally save considerable oil from what has previously been poured in through a common cup, but the special advantage of an improved lubricator is that it supplies the oil to the rubbing surfaces at the time it is most wanted. If the same quantity of oil is used by a steady feed that was used by the interval system of oiling, the steady feed is certain to be by far the most economical of the two. This is a fact which the men responsible for the care of locomotives need to clearly understand. For want of a proper conception of the real advantages of a steady feeding apparatus, those who have introduced sight oil feed cups have often reaped no benefit from the change.

Reservoir Exhaust Pipes.

On another page of this paper will be found a form of exhaust pipe in use on the Kansas City, Fort Scott & Gulf Railroad, and which is reported to be of decided service in making the engines to which it is applied work more freely than with the common exhaust pipe. There is nothing very abstruse about the design of the exhaust pipe. The idea controlling its design is to make a vessel that will enable the steam to pass out of the cylinders as quickly as possible, and serve as a partial reservoir to give the steam to pass out of the exhaust nozzle. The single nozzle has been by no means a uniform success with high exhaust pipes, and we are strongly of the opinion that most of the reported failures have happened through the exhaust pipe being too small to permit the steam to escape freely from the cylinders. Designers are apt to reason that if the cross section of the exhaust pipe be greater than the opening of the exhaust passages through the cylinder casting, it must be large enough to permit the steam to escape freely. The reasoning seems unassailable, but recorded facts prove that where an enlarged exhaust pipe has been employed, other things being equal, the steam escapes with considerably less back cylinder pressure than where a smaller pipe was used. When the exhaust opens and the imprisoned steam shoots for the atmosphere, the rush is partly arrested by the restricted exhaust nozzle, and the less room there is to hold the obstructed steam the greater will be the pressure left in the cylinder. If the exhaust pipe can accommodate a large percentage of the steam for the fraction of a second while it is crowding through the nozzle, the resistance to the movement of the returning piston will be considerably lessened.

The small locomotives used for performing the work on the elevated railroads of New York have an exhaust steam reservoir in their smoke box, which with the pipe has about half a cylinder capacity. This reservoir has added materially to the efficiency of the engines, and has enabled the company to employ an uncommonly large nozzle which prevents spark throwing and economizes fuel. It has always been a surprise to us that surface roads did not imitate the elevated railroad people in the exhaust pipe design, for with an extension front and open stack, there is no objection to having the steam reservoir in the smoke box. If any company near New York would try the experiment of running an exhaust pipe similar to that used by the Kansas City, Fort Scott & Gulf against a common exhaust pipe on locomotives in other respects the same, we shall be glad to make indicator tests to ascertain the relative value of the two forms of pipe.

Modern Snow-Working Machinery.

The unusually mild winter experienced in the States east of the Rocky Mountains has given railroad companies an excellent opportunity to move the vast volume of freight offered at the lowest possible cost. The appliances kept in stock for clearing the tracks of snow and ice have been little used this winter, but nothing pays railroad companies better than letting that kind of apparatus remain in the house. We learn from an officer of the Northern Pacific that owing to the perfected system of snow fences provided all over the road, the snowfalls of this winter have not caused any delay east of Montana, although the quantity was sufficient to have caused blockades when the provisions against it were less perfect than they now are. This is a case where a dollar's worth of prevention is worth twenty dollars' worth of remedy. Besides having the system of fences and snow sheds as nearly perfect as it can be made, the Northern Pacific maintains an excellent equipment of rotary steam snow shovels, which are always ready to deal with a heavy snowfall before a serious obstruction can happen.

If the East has passed lightly through the snow troubles of this winter, the western side of the continent has had a different experience. The snowfall in some portions of the Pacific Coast has been the heaviest known for years, and the railroads have suffered intensely. The snow working machinery has on some roads met with obstacles in the form of immense snowdrifts and ice-bound barriers that were beyond their capacity for clearing away. But, on the whole, the tremendous snow storms and the resulting blockades have given the owners of snow-working machinery an excellent opportunity to display the capacity of their apparatus, and steam-worked machinery has achieved a great victory. The Leslie rotary has done "wonderful work," as a superintendent of motive power expressed it, the principal regret heard being that there were far too few of the machines available for the great amount of labor to be performed. The Cyclone steam snow plow has also done all that its friends claimed the machine would do, and its capacity for handling deep drifts was tried to the utmost. A machine that will work through snow from 8 to 12 feet deep for a distance of 1,500 feet in ten minutes, throwing the snow a distance of 250 feet, develops immense power and utility in performing the object of the design. This is one of the best feats which the cyclone plow is reported to have done. The Jull excavator is also reported to have excavated snow from deep cuts with much expedition.

The lesson of the work done by these machines is that the mechanical methods of clearing away snow are efficient, and that the old system of bucking snow by wedge plows run at high speed must soon become obsolete, like many other dangerous and inefficient practices. Nearly all the railroads in the snow belt east of the Mississippi River have yet failed to provide themselves with modern machinery for snow handling, but they may receive very rude awakening to the necessity for having something better than wedge plows to fight snow with. The imbecility in grappling with the snow obstructions caused by the blizzard that visited the Atlantic States two years ago was forgiven because the public had not become familiar with steam-worked snow excavation. The excuse will not find many patient hearers should the necessity arise for its being offered again; and all that is required to make the excuse necessary is the snow. Leaving the arteries of traffic blocked for days till antiquated means can be operated to overcome the obstructions will not be tolerated patiently, and the killing of men by the recklessly dangerous practice of rushing into deep snowdrifts at high velocity with lumbering wedge plows driven by a string of heavy locomotives will not be excused as unavoidable accidents. The rotary mechanical principle of handling snow is an admitted success, and its recognized utility puts new duties upon railroad managers. Progressive men must adopt it just as they have adopted the air brake and other safe and useful appliances.

The Chilled Car Wheel Standards.

The paper written by Mr. W. W. Snow on Contract for Chilled Car Wheels, and read by Mr. J. N. Lauder at last meeting of the New England Railroad Club, raises objections to the form of contract for chilled car wheels which has been adopted by letter ballot and made by that means a standard of the Master Car Builders' Association. We were surprised that the proposal to open this question was received so meekly by the members of the New England railways, but we suppose most of them are entirely indifferent about any form of contract for car wheels, since it has been the practice of railroad officers to ignore what was reputed to be the settlement of the question. Under the circumstances, it appears of little consequence whether the subject be brought forward for renewed discussion or permitted to rest. The subject was twice before the Master Car Builders' conventions and was carefully considered by a joint committee from the Master Car Builders', Master Mechanics' and Car Wheel Makers' associations, and there was very little excuse for any omission in the form of contract that would call for amendment as soon as the agreement was ratified. Mr. Snow intimates that the omission of wheels removed because of the sharp flanges from the list of defects for which makers are not responsible, is imposing a hardship upon the makers. The wheel makers wish to make an amendment specifying that where wheels are removed for sharp flanges, the flange shall be broken, and if the fracture shows a good bright chill, it shall be evidence the flange wear was produced by other causes than those for which the wheel maker is responsible. No one with any sense of justice could have objected to this, had it been proposed when the agreement was under discussion, but it is a different matter opening up a question just settled.

While on this subject, we think it a seasonable time to remark that the practice of ignoring established standards by those responsible for voicing their adoption is far from being creditable to those concerned. Railroad companies, respectable wheel makers, and the traveling public are all interested in the movement to improve the quality of cast-iron car wheels by the establishment of a standard specification. The subject was freely discussed, and no

one disputed its importance. The joint committee already referred to labored diligently to produce acceptable specifications, and they were accepted in the perfect faith that their adoption would make the cheap, weak, dangerous wheel a thing of the past, but alas for the truth. The specification and guarantee were adopted by a large majority of votes, only to be hurriedly consigned to oblivion by those who brought about the result. When master car builders and others are remonstrated with about this, they generally answer that they have nothing to do with the buying of car wheels. They may not have the purchasing of wheels but that does not by any means relieve them of responsibility. How many purchasing agents are aware that the railroad companies belonging to the Master Car Builders' and Master Mechanics' associations have adopted a standard specification and guarantee of a cast-iron car wheel? Very few, we feel safe to assert. Is it not the duty of the master car builders and master mechanics to keep their purchasing agents informed about matters of this character? We certainly think it is, and further we feel assured that had the proper representations been made on the matter concerning car wheels which passed the letter ballot it would not now be the dead letter it has already become.

How to Make Harmony on the Union Pacific.

Two months ago a rumor reached us as we were going to press to the effect that Mr. G. W. Cushing, superintendent of motive power of the Union Pacific, was about to retire. We wrote to Mr. C. F. Adams, President of the Union Pacific, asking what ground there was for the rumor, and in reply have been informed that it was without foundation. At the same time Mr. Adams wrote in the very highest terms of the valuable services which Mr. Cushing had performed for the company. Mr. Adams further took very strong grounds against the practice of changing the heads of the mechanical department, and expressed the belief that a change of the kind would cost the Union Pacific $500,000. We may depend upon it that Mr. Adams' business sagacity will cause him to offer the very strongest opposition to a change of superintendent of motive power, when he considers the change so costly; yet, nevertheless, rumors are constantly reaching us from Omaha that a change is about to take place. It is well known that certain Union Pacific officers at Omaha strongly opposed the appointment of Mr. Cushing, and people who have had exceptional opportunities to investigate the matter inform us, not only that the opposition has been kept up, but that certain newspapers have been influenced to help in assailing the head of the mechanical department. The men who are guilty of this kind of conduct injure the company employing them a great deal more than they injure the man they are trying force out of the service. The Union Pacific is not the only line where old officers devote more of their attention to kicking against new ones than to doing the work they are paid to perform. Where this spirit prevails there can be neither peace, harmony, nor well conducted service, and the proper plan for the head of the company to pursue is to discharge those who display hostility to the appointments made no matter how old or how high up they may be. How can the Union Pacific Railroad Company expect to have faithful and rule abiding employés when it is notorious that a cabal inside the management has combined to fight against the head of an important department?

M. C. B. Couplers in Service.

In the absence of any other interesting topic the subject of "the merits of the Master Car Builders' car coupler" continues to occupy the attention of railroad men. Rumors have been rife that the hook couplers in use were failing at a disastrous rate, and a very general desire has been manifested for exact facts in regard to the case. These have now been supplied very liberally, so far as the Janney coupler is concerned. The McConway & Thorley Company of Pittsburg, manufacturers of the Janney coupler, have given to the press very full data regarding the breakages of their car couplers in service and of the cost of maintaining this form of draw bar. The data is much too voluminous for our columns, but *Engineering News* publishes eight pages of the information about the coupler, consisting of analyses and tables showing the various lines of breakages and expense, illustrations showing the breakages, and diagrams giving a graphical record of the character of the breakages. The record is believed to be complete for 45,617 couplers on 11 leading lines, the average term of service having been 10 months. It also includes partial records from 25,814 more couplers, most of them of more recent service.

The record supplies very valuable testimony in favor of the durability of the M. C. B. type of coupler, and it has every appearance of being perfectly fair and reliable. The failures recorded were at the rate of from 2¼ to three couplers per annum for each 100 couplers in service. Two-thirds of these breakages were classed as being due to original defects, and the couplers were replaced by the makers free of charge. The remaining third of breakages, which have generally been caused by the rough usage to which all couplers are subject, constitutes only about from .8 to one per cent. per annum of the couplers in use. The knuckles break much more frequently, as might be expected, but the total expense due to broken drawbars of this type is much lower than we had been led to believe would be the case. We have had private information from the officers of roads using other forms of the M. C. B. coupler, and, therefore, not mentioned in the record given of the Janney coupler, which substantiates the accuracy of the figures supplied by the McConway & Thorley Co.

The mild winter has prevented satisfactory progress from being made in the heating of cars by steam, but it is noticeable that the dangerous stove is quietly disappearing from through trains. We have found it necessary to travel a great deal during the last two months, and it has surprised us to find the new systems working so smoothly. The only complaint that could be made was in some instances the cars were heated too much, but there will always be some one ready to complain about the temperature or ventilation of a car. On questioning conductors about their experience with steam heat, we found that most of them believed that complaints among travelers were fewer than they used to be against the varying temperature common with stoves and heaters. Many of the railroad companies and all the sleeping-car companies are imposing very strict rules upon trainmen respecting the care to be exercised in maintaining an even temperature inside the steam heated cars. If the companies concerned would assist their employés to keep an even temperature by supplying them with good thermometers, it would be worth a great many iron-clad rules. Where dial thermometers are provided, the passengers take good care that the temperature does not vary very far from 70 deg. When it happens to drop five deg. below that, the grunting to be heard soon brings the conductor to a realizing sense of the situation.

A sleeping car heated by steam requires more attention to maintain an even temperature than the car warmed by hot water call for, and the effect of carelessness on the part of a porter is soon apparent. If the steam is left on and all the pipes and the ventilators closed, the temperature very soon becomes oppressive; if the action is reversed, the car cools down quickly. The porter cannot go to sleep soundly for two or three hours in a steam-heated car without the passengers suffering from his neglect. Porters as a rule are fairly careful men, but there are exceptions, and when one of these freezes or parboils a car-load of passengers for half a night, there is apt to be complaints heard about the system of heating the misery is caused under.

Our correspondent, "Progressionist," whose letter on the "Double Card System" appears in another column, makes a very strong argument in favor of the proposed change in the rules of interchange of cars, providing for two defect cards, one for old defects, the other for new ones. Our correspondent has great experience in the interchange of cars, and has, for many years, made the means of facilitating the movement of cars a special study. He has no hobby to ride, and no axe to grind. What is best for the interests of railroad companies generally will be certain to receive his support. The reminder that the objections now raised to the system of double carding were urged originally against carding of any kind, is perfectly cogent and indicates the real value of the opposition likely to be brought against the change. It may be that the opponents of the double card system will have some better arguments than an abstract plea for leaving things as they are, but if that is the case we have not heard them. One thing is certain — there are many and tedious delays of freight cars at intermediate points, and the disputes that cause the delays arise about who is responsible for old and new defects. If an improvement in the system of carding is likely to lessen the disputes and delays, it is certainly the duty of the members of the Master Car Builders' Association to try how the change will work. It would be a wise plan for the Master Car Builders to try a remedy before the patience of higher officers is entirely worn out.

Some of the people interested in our transportation problems have been greatly excited about the dangerous activity of the Canadian Pacific in grasping business from the transcontinental railroads of the United States. The latest cause of apprehension is the attempt of the Canadian Pacific to rob our lines of California business. That Canadian free lance railway is certainly a most aggressive sinner, but if the company can compete with American lines on the California through business, it is high time that the latter companies were giving up the transportation of through freight.

Owing to some unexplained delay with the cuts for the article by Mr. Voss on Railway Car Construction, we are compelled to omit it this month. We very much regret this, as the article is unusually interesting and valuable.

We published a large number of extra copies of the NATIONAL CAR AND LOCOMOTIVE BUILDER last month in the expectation that there might be an unusual demand for the paper on account of the illustrations and description of the Michigan Central compound locomotive being in it. But the demand proved far in excess of our calculations, and we were compelled to refuse hundreds of applications for extra copies. On this account we have reproduced some of the cuts of the compound locomotive in this issue and given a great deal of interesting information about the working of the engine. Our letter files give us ample evidence that there exists on this continent a very lively interest in the subject of compound locomotives. This journal has a very large circulation among railroad officers, yet extra copies were requested from all the states in the Union besides many from Canada and a few from Mexico. We are making preparations to supply a large extra demand of this month's issue.

New Publications.

A HANDBOOK OF ENGINE AND BOILER TRIALS. By R. H. Thurston, M. A., etc. John Wiley & Sons, New York.

A notable tendency of engineering is not to take anything for granted, but demonstrate its value by practical tests. The testing of engines and boilers is generally of the first importance, yet engineers who undertake to conduct tests habitually neglect to make proper provisions for finding out accurately facts which are of the first importance. The conducting of engine trials has to be learned like most other work requiring skill, and a book that will give assistance to a learner in this line of engineering is certain to be valuable. The latest work by Professor Thurston is a hand-book of engine and boiler trials, which will be of great service to engineers perfecting themselves in carrying on the work of engine and boiler tests. The book has been prepared for the use of young engineers and for technical schools. The only fault that we can see to the book is that the author follows his usual practice of using abstruse mathematical formulas on all occasions where they can be dragged into the text. Some of our learned writers on engineering subjects seem to be always haunted by the fear that the world will not understand how learned they are unless they parade on every page their familiarity with higher mathematics. The author in explaining the purpose of the book says he has "sought to compile a concise, accurate and satisfactorily complete account of the apparatus and methods of the time, as familiar to the most experienced and accurate specialists." In this he appears to have been entirely successful. Engineers in doubt about the best apparatus and methods to be employed in engine trials will here find particulars of the most advanced practice.

PRACTICAL BLACKSMITHING, by M. T. Richardson. Vol. II. Published by the author.

The author of this book, who is editor of the *Blacksmith and Wheelwright*, is collecting in book form articles that have appeared in various journals by different authors and have a bearing on the blacksmith's art. We have already noticed the first volume. The second volume, which has lately come to hand, contains chapters on iron and steel, bolt and rivet clippers, and a number of others relating to blacksmith's work. The chapter on iron and steel contains some very good selected articles on the working of iron and steel that would be valuable to many blacksmiths. Throughout, the book is an acceptable contribution on subjects that are not written threadbare.

Messrs. John Wiley & Sons, New York, have in the press a revised and enlarged edition of *Sinclair's Locomotive Engine Running and Management*. A great deal of obsolete matter has been cut out, and new parts written making the information of the kind that applies entirely to the locomotive of 1890. Several chapters have been taken out altogether and others treating of new subjects introduced. Among the new subjects to which chapters are devoted are draft appliances; combustion, and steam and motive power. Men interested in the economical management of the locomotive will find this book a valuable assistant.

THE ENGINEERS' SKETCH-BOOK OF MECHANICAL MOVEMENTS, DEVICES, APPLIANCES, CONTRIVANCES AND DETAILS. By Thomas Walter Barber. E. & F. N. Spon, New York. This book appears to contain a sketch of nearly every contrivance used in engineering. It looks as if all the sketch memoranda taken by several generations of practical engineers had been digested into compact form and published in this handy volume. It ought to be of incalculable service to draughtsmen and designers, for it would be hard to conceive a mechanical movement desired which this book would fail to give aid in scheming. It is sold for $3.

We have to acknowledge the receipt of a handsomely bound volume of the *Fireman's Magazine* for the year 1889. The volume contains a great deal of practical information about locomotives which cannot fail to be useful to the readers of the magazine. Its management reflects the highest credit on the able editor, Mr. E. V. Debs, of Terre Haute, Ind.

Personal.

Mr. Walter Graham, general manager of the Galveston & Western, has resigned.

Mr. W. F. Kearney, whose appointment as general master mechanic of the Ohio, Indiana & Western, we announced last month, died three days after taking the position.

Mr. Thomas Butler, the general foreman of the Pennsylvania Company's shops at Fort Wayne, has been promoted to the position of master mechanic of the company's shops at Crestline, O.

Mr. Charles Blackwell has resigned the position of superintendent of the Toledo, St. Louis & Kansas City, to enter the employ of Shoenberger & Co., the well known steel makers of Pittsburg.

Robert T. Devries, superintendent of the Columbus and Newark and Ohio Divisions of the Baltimore & Ohio Railroad, has resigned. He had been in the service of the Baltimore & Ohio for 30 years.

Mr. George T. Jarvis has been appointed superintendent of the Ohio division of the Baltimore & Ohio road, vice R. T. Devries, resigned. Mr. Jarvis was formerly superintendent on the Duluth, South Shore & Atlantic road.

It is rumored that Mr. E. B. Thomas, vice-president of the New York Lake Erie & Western, was urged to accept the position of president and general manager of the New York, New Haven & Hartford, and that he declined.

Mr. L. D. Richardson, late superintendent of the weighing bureau of the Central Traffic Association at Chicago, has been appointed superintendent and general freight and passenger agent of the Hot Springs Railway Company.

Mr. John Black, Jr., has been appointed general foreman of the New York, Chicago & St. Louis shops at Grand Crossing, Ill. Mr. Black was for several years foreman of the Cincinnati, Hamilton & Dayton shops at Lima, O.

James Steward, assistant master mechanic of the Pittsburg, Fort Wayne & Chicago, at Fort Wayne, Ind., has been promoted to be assistant superintendent of the block signal service, with headquarters at Pittsburg, Pa.

Mr. Harry Monkhouse has been appointed assistant general master mechanic and assistant general master car builder of the Chicago, Rock Island & Pacific Railway Company's lines west of the Missouri river, with headquarters at Horton, Kan.

It is currently reported, though not yet officially announced, that Mr. J. T. Harahan, who recently resigned the position of general manager of the Big Four, will return to his old position on the Louisville & Nashville, of which road he was for some time general manager.

Mr. E. D. Bronner, general foreman of car repairs of the Michigan Central, at Detroit, has been appointed master car builder. This will relieve Mr. Robert Miller, assistant general superintendent, who has been master car builder also, of part of his duties.

Mr. John Hewitt, of the Wabash, has been appointed master mechanic of the Oregon Railway & Navigation Company in place of Mr. J. Evans, resigned. Mr. Hewitt, as most of our readers will remember, was long general master mechanic of the Missouri Pacific.

Mr. George F. Wilson has been appointed general master mechanic of the Chicago, Rock Island & Pacific Railway Company, in place of Mr. T. B. Twombly, resigned. Mr. Wilson's jurisdiction will extend over this company's lines both east and west of Missouri River, with headquarters at Chicago.

Mr. Robert Blee, general superintendent of the Cleveland, Columbus, Chicago & St. Louis, has resigned and will retire to private life. Mr. Blee has been in railroad service for 37 years, the greater part of it having been passed on some part of the system he has just left. He began work as a brakeman.

Mr. Charles J. Harrah, President of the Midvale Steel Works, died at Philadelphia last month. The greater part of Mr. Harrah's life was spent in Brazil, and he raised himself from penury to affluence in that country. Some of the most difficult work of railway construc ion was done by a company of which he was a leading member.

M. H. H. Vreeland, who has been superintendent of the New York & Northern for the last year, has been appointed general superintendent of the line. He entered the service of the company in 1881, and was appointed trainmaster in 1887. He was previously, between 1875 and 1881, in the transportation department of the Long Island road.

At a recent meeting the directors of the New York Central Railroad created the office of general manager, and promoted General Superintendent John M. Toucey to the position. Mr. Toucey has been with the New York Central since 1855, and no officer belonging to the road has put more personality upon the conduct of its affairs.

Mr. George W. West, who has been appointed to succeed Mr. H. Tandy as superintendent of motive power of the New York, Ontario & Western, has been for some time master mechanic of the New York, Lake Erie & Western, with charge of the divisions running out of Jersey City. Mr. West was previously on the West Shore, having been brought there by Mr. R. H. Soule.

Mr. James J. McAlpine, one of the most eminent engineers in the country, died at New Brighton, N. Y., last month. Mr. McAlpine was born in 1812, and during his professional career was engaged on some of the leading engineering works of the country. He was for a time Railroad Commissioner of New York State. He made considerable mark as a writer on engineering subjects.

Mr. J. R. Billinton, chief locomotive draughtsman to the Midland, of England, has been appointed to succeed the late Mr. Stroudley as locomotive superintendent of the London, Brighton & South Coast. Mr. Billinton was originally in the service of the Brighton. The English plan of promoting the chief draughtsman to take the position of superintendent of motive power might be followed to advantage by railroads in this country.

Mr. Theodore Voorhees, who succeeds Mr. John M. Toucey as general superintendent of the New York Central, is an engineering graduate of Rensselaer College, Troy, N. Y. He was for some years on the Delaware, Lackawanna & Western and left that to enter the transportation department of the Delaware & Hudson Canal. From there he went to the New York Central as assistant general superintendent. He is a bright railroad man and an accomplished writer. He is a relative of the Vanderbilts.

Mr. Henry Snyder, general manager of the Union Switch and Signal Company, died at his home near Pittsburg, Feb. 9, and was buried at Philadelphia on Wednesday. He had a wide acquaintance among railroad men, and his death will be regretted by them as a personal loss. Before Mr. Snyder became general manager of the Union Switch and Signal Company he had been agent for the Westinghouse Air Brake Company, and in both positions his energy and his loyalty have made him most useful to the interests that he served.

M. Hirn, the famous Alsacian engineer, who first experimented with the steam engine in order to discover the amount of heat which disappears in it on producing mechanical work, died at Colmar last month. This engineer was the first to introduce the modern system of preparing balance sheets showing the disposal of heat in engines and boilers. The well-known and highly honored names of the pioneers in engine-testing are slowly becoming fewer and fewer, and the news of M. Hirn's death will be received by engineers with great regret.

Mr. Richard N. Allen has been elected president of the Allen Paper Car Wheel Company. The election confers an honor upon one thoroughly entitled to the position, for Mr. Allen is the inventor of the paper wheel, and was a leading organizer of the company, and superintended the erection of the wheel works at Pullman. As might be expected, Mr. Allen has for years made the subject of steel tired wheels a special study, and he enters upon his duties with a fund of knowledge and experience that ought to make his return to active duty of the highest value to the company.

Mr. John B. Mulliken, vice-president and general manager of the Chicago & West Michigan, and general manager of the Detroit, Lansing & Northern, has resigned, and will be succeeded by Mr. Charles M. Heald, lately president of the New York, Susquehanna & Western. Mr. Mulliken has been in the railroad service for 35 years. He was station agent at various places between 1855 and 1874. Between October, 1874, and May, 1875, he was division superintendent of the Chicago & Northwestern. Mr. Mulliken has since been connected with the Detroit, Lansing & Northern, first as general superintendent, and since 1877 as general manager.

At the last meeting of the Northwestern Railroad Club, Mr. W. H. Lewis read a paper on axles for heavy tenders, in which he recommended for adoption by the master mechanics of the country for heavy tenders the last standard axle adopted by the Master Car Builders' Association. He wanted the axle modified in form, making the diameters of dust guard and collar 4 inches and $4\frac{7}{8}$ inches respectively. He spoke in favor of retaining the collar on the axle journals, because the collar tends to prevent arch bar trucks from spreading. Several members of the club expressed their views, but there was little diversity of opinion as to the course recommended by Mr. Lewis.

Slip of Driving Wheels.

A correspondent, whose letter we have overlooked for several months, writes: "Will you let me know the reason why an engine will slip running down hill with the steam shut off? On the Northeastern, a passenger engine was turned out of the shops lately, and she at all times slips going down hill when running over 25 miles an hour. At high speed the slip of the drivers is very perceptible.

ANSWER.—The slip is caused by the counter-balance weights in the driving wheels being too heavy. The thing is quite common, although its existence is denied by some would-be experts.

American-Made Plush.

Up to the year 1882 the only car plushes used in this country were those of foreign make. In this year the Sanford Mills, L. C. Chase & Co., selling agents, started in the manufacture of car plushes, and after three years of experiment placed on the market a plush which was immediately recognized as the best ever made.

Their car push is made entirely on patent looms, consequently they have a firmer and more even face than can be obtained by foreign goods, which are take entirely on hand loom power. Another advantage, they take the mohair in its crude state and carry it through the different processes of manufacture until it is ready to be put on the cars. The yarns for German and French plush are made in Brandford, and then sent to the continent and distributed from house to house where a man has one or two looms. It is claimed that car plushes are not made in England on account of their not being able to get a fast color.

Sanford Mills plushes ars guaranteed for their superiority and fastness of colors over all plushes made. This fact has brought them before the largest car-builders in this country, who after careful experiments of the goods will fully indorse all that has been said.

Darling, Brown & Sharp, of Providence, R. I., have put on the market a new draughtsman's protractor which is certain to become a favorite tool. An illustrated description of the protractor may be obtained on application to the makers.

Among recent orders for the American draft and buffing apparatus is 1,500 cars for the Pitts. & Western, 900 for the B. & O. So. W., 800 for the Ill. Cent., 280 for Swift's Packing Company, beside several small orders of from 100 to 300 cars.

The Tripp Manufacturing Company, of Boston, who are the sole manufacturers of the celebrated Tripp anti-friction bearings and Tripp's metallic packing, have removed to 180 Summer street, where they have elegant offices. Their rapidly increasing business necessitated the change.

The Van Dorston Cushion Car Coupling Equipment Company, Philadelphia, have issued a new illustrated pamphlet showing their coupler with its various details. This coupler has been adopted by the Philadelphia & Reading Railroad, who are applying 8,000 of them. The double and triple acting draft gear gives additional strong features in connection with the cushioned couplers, from the fact that the draft is taken at both ends of the car at the same time, thus affording double capacity, diminishing the shocks, increasing the life of the cars and decreasing the general repairs.

The Stone & Wieskapf Co., of Pittsburg, are meeting with the most encouraging results with their patent oil cellar bearing. Although but two years in the market, their orders are increasing daily. The company has most excellent facilities for turning out all kinds of car bearings and locomotive bronze castings, having a large foundry building 80 × 120 feet, with ten economic natural gas furnaces, with a daily capacity of 12,000 pounds of metal. The Stone patent oil cellar bearing possesses merits not to be found in any other make. It cannot fail to give its required results as long as there is oil in the journal box. The cellars, while the train is in motion, will naturally fill themselves; the oil being in the proper place for service there is no possibility of heating. It will better fit and adjust itself to the journal owing to the proper manner in which it is lined. This style of bearing is now being principally used for fast passenger trains, and in several cases they have made 200,000 miles service. The comparative cost is somewhat less than the ordinary bearing, and no alteration or extra cost is necessary in the use of the same.

The National Hollow Brake Beam Company, of Chicago, Ill., have recently built extensive works for the manufacture of their brake beams. They have adopted every modern appliance for the rapid and easy handling of the material used in the shops; they have tracks running the entire length and width of the buildings, with numerous turn-tables, enabling them to take in the metal at one end, and after going through the different processes the brake beams are finished near the shipping room by the side of the railroad track with the least amount of handling; the buildings are 156 × 120 feet, the main shop 156 × 60, storage and shipping rooms 40 × 60, with a capacity of 5,000 brake beams, and the blacksmith shop 76 × 60. The entire buildings are heated and ventilated by the "Sturtevant" system, which gives entire satisfaction. They are lighted with electric lights, and as there are no posts in the shops (the roof being supported by truss beams 14 inches in diameter), every inch of the floor space is available. They have the latest improved and special machinery, including a testing machine, with which every brake beam is tested before leaving the shop to nearly twice the amount of strain they would be subjected to in actual service. They are also making arrangements to manufacture the Westinghouse brake beam in addition to their own, and are putting in a special plant for that purpose.

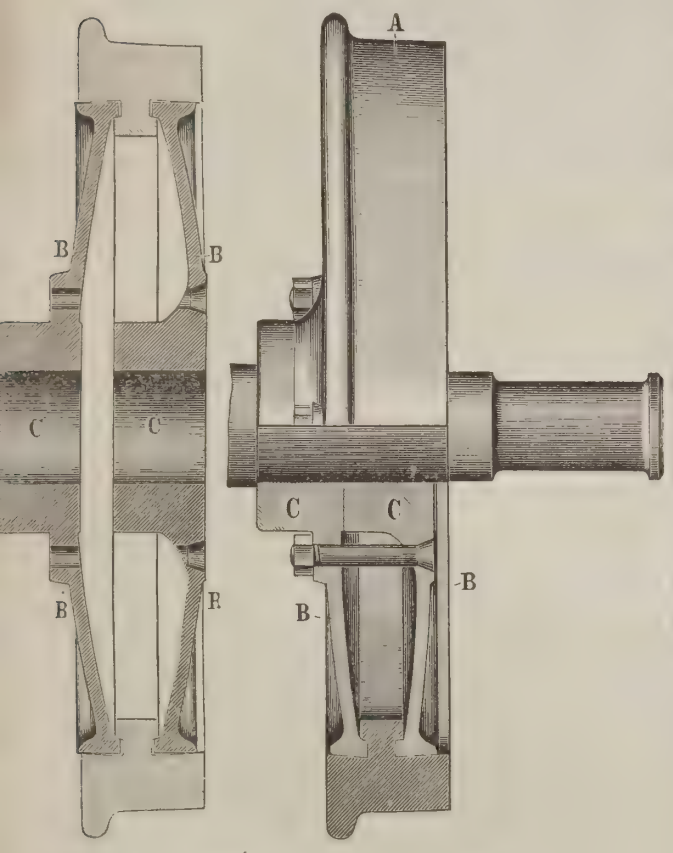
Victor Colliau, of Detroit, the inventor of the Colliau Hot Blast Cupola, reports business as being very good. He has put up quite a number of his cupolas recently, and has orders for several more.

Six new and elegant coaches have been ordered by the I. & G. N. These coaches will all be supplied with the Scarritt seats, richly upholstered and having the new conveniences for baggage and facilities for car cleaning. These seats will be furnished by the Scarritt Furniture Co., St. Louis.

We commend to the attention of car builders and others interested in having work done expeditiously and cheaply the merits of the Montague-Woodrough saw. We know that this saw will do its work with half the labor exerted with an ordinary saw. The teeth are arranged in groups of three, with a gullet between each section to take up the loose sawdust. There two cutting teeth and one cleaner tooth in each group. One cutting tooth cuts right, the other left, and the cleaner tooth removes the wood between these two cuts and pushes it into the gullet, so that the next pair of cutters have nothing to hinder them in their work. The cleaner tooth is filed a little shorter than the cutters, so that the wood is cut free and smooth on each side of the gash before it is removed. The gullets clear themselves as the saw is drawn back into the wood, leaving them ready to take up the next lot of sawdust. The cutting teeth are set by throwing out the front edge, so that each cutter acts like a chisel and cuts perfectly smooth. By rubbing with an oil stone, laid flat upon the side of the teeth, it can be kept sharp for a longer period than other saws. Do this until all the set is rubbed out.

The car wheel illustrated by the annexed engraving is thus described by the makers:

The wheel is composed of three principal parts, consisting of the tire *A* and two disks of cast steel *B B*, having sections



STEEL TRUSS CAR WHEEL.

of the hub *C C*. The tire is provided with a beveled retaining ring, and the disks with shoulders on their outer rim *B B*, corresponding on the inside with the shape of the grooves in the tire, and forming on the outside the necessary bearing surfaces to support the outer edges of the tire.

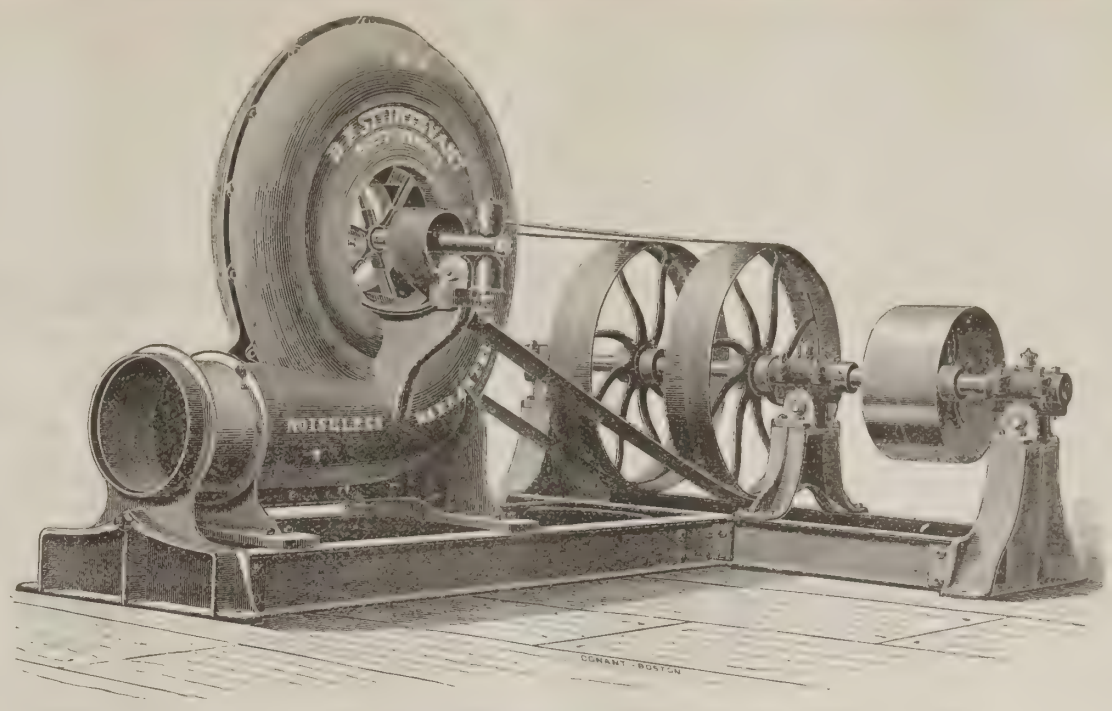
The plan followed in joining the tire and disks together is as follows: The tire is first heated and shrunk on the disks as shown in Figs. 1 and 3, which leaves a space of about seven-eighths of an inch between inside shoulders of hub sections. The clamping shoulders of the disks are then forced into the retaining ring of the tire under hydraulic pressure of from ninety to one hundred tons, until shoulders of hub sections meet as shown in Fig. 2, thus forming an absolute truss.

After the wheel is together, as shown in Figs. 2 and 4, four bolts are inserted around the hub to prevent the springing of the disks at center or hub, before the wheel is pressed on the axle.

The inclined form of the groove in the retaining ring on the tire, and corresponding inclination of the clamping shoulders on the disks, when forced together by hydraulic pressure, makes a connection between the tire and center which will prevent slipping of the tire under the most severe brake pressure that can be applied. In case of accidental breakage of the tire, the retaining ring will hold the broken section in place and prevent further damage.

The thickness of the disk proper is one-half inch, and of the hub one and seven-eighths inches. The strength of this construction and the material used is fully demonstrated by the fact that we are now applying wheels to axles under a pressure of from seventy to ninety tons.

The merits specially claimed for the wheel are: Great strength combined with lightness, and elasticity combined with the features that insure absolute safety. The tires are guaranteed for 260,000 miles. The wheel is made by the Steel Truss Car Wheel Company, St. Louis, Mo.



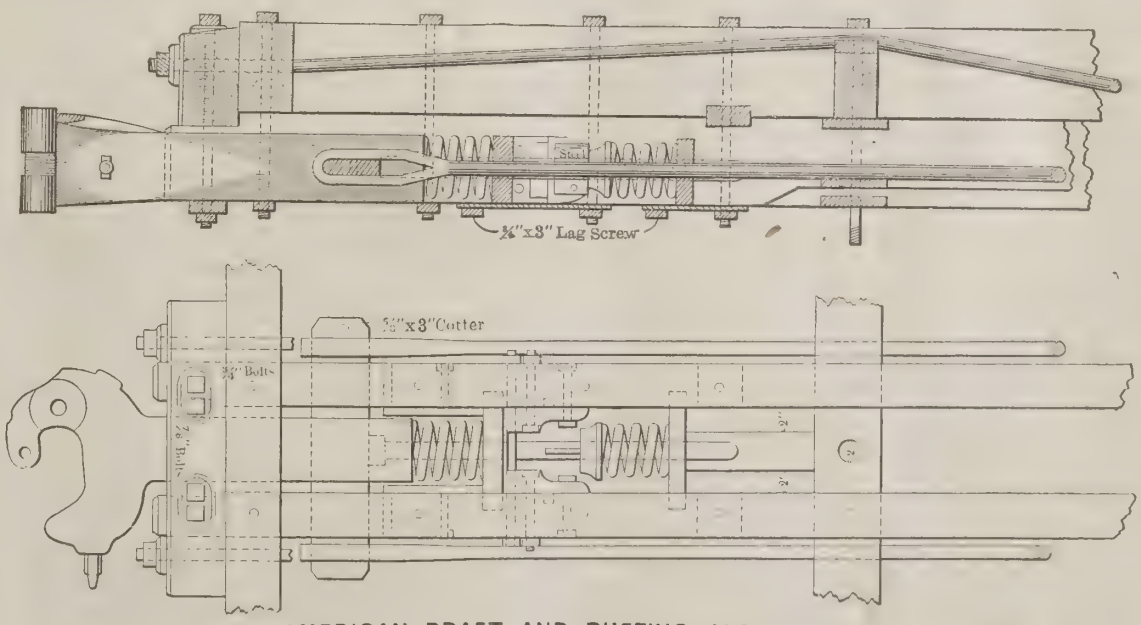
STURTEVANT STEEL PRESSURE BLOWER ON ADJUSTABLE BED.

The accompanying cut shows a steel pressure blower, made by B. F. Sturtevant of Boston, Mass., with a combined countershaft mounted on a wrought-iron frame work, forming a substantial bed, upon which the blower may be moved forward and backward by means of tightening screws placed underneath the blower between the sides of the bed. At the mouth of the blower is a telescopic air pipe, so that the blower may be moved without disarranging the blast pipe in any way. The ability to move the blower upon its bed, even when it is running, enables a uniform tension to be kept upon the blower belts at all times and in all conditions of the atmosphere, and does away with the annoyance usually encountered in running a pressure blower with two belts, because of the difficulty of obtaining an equal tension upon both belts. The perfect alignment of the countershaft with the blower shaft, together with the ability to regulate the tension of the belts, causes them to track perfectly and to last for years, since they are not subjected to any wear by striking against the hanger or the side of the blower, as is usually the cause with blower belts running at high velocities, and driving an imperfectly aligned blower. The belts furnished with the blower are endless, and made especially for driving blowers, from the best oak tanned leather belting.

George Westinghouse, Jr., C. H. Jackson, President and Vice-President of the Standard Car Heating and Ventilating Company of Pittsburg, Pa., have become directors and large shareholders in the Consolidated Car Heating Company of Albany. The interests of the Pittsburg company are thus consolidated with the Albany company, which, by the arrangement, greatly extends the field of its operations and becomes the owner of an additional number of valuable patents and improved devices for heating and ventilating railway cars and lighting such cars by electricity. Automatic regulation of heat, which will obviate the complaints of the variable temperature of steam heated cars, is also secured by an attachment to the air-brake cylinder with which all cars are already equipped. Several of the features of the heating systems of the Standard Company have lately had considerable trial upon the Pennsylvania and Baltimore & Ohio roads with favorable results.

The Acme Machinery Company, of Cleveland, O., report a better business than at any previous time. They are sending their Automatic Bolt Cutting machines not only all over the United States and Canada, but have recently sent some to England, Cuba and Chili; they also make bolt heading machines.

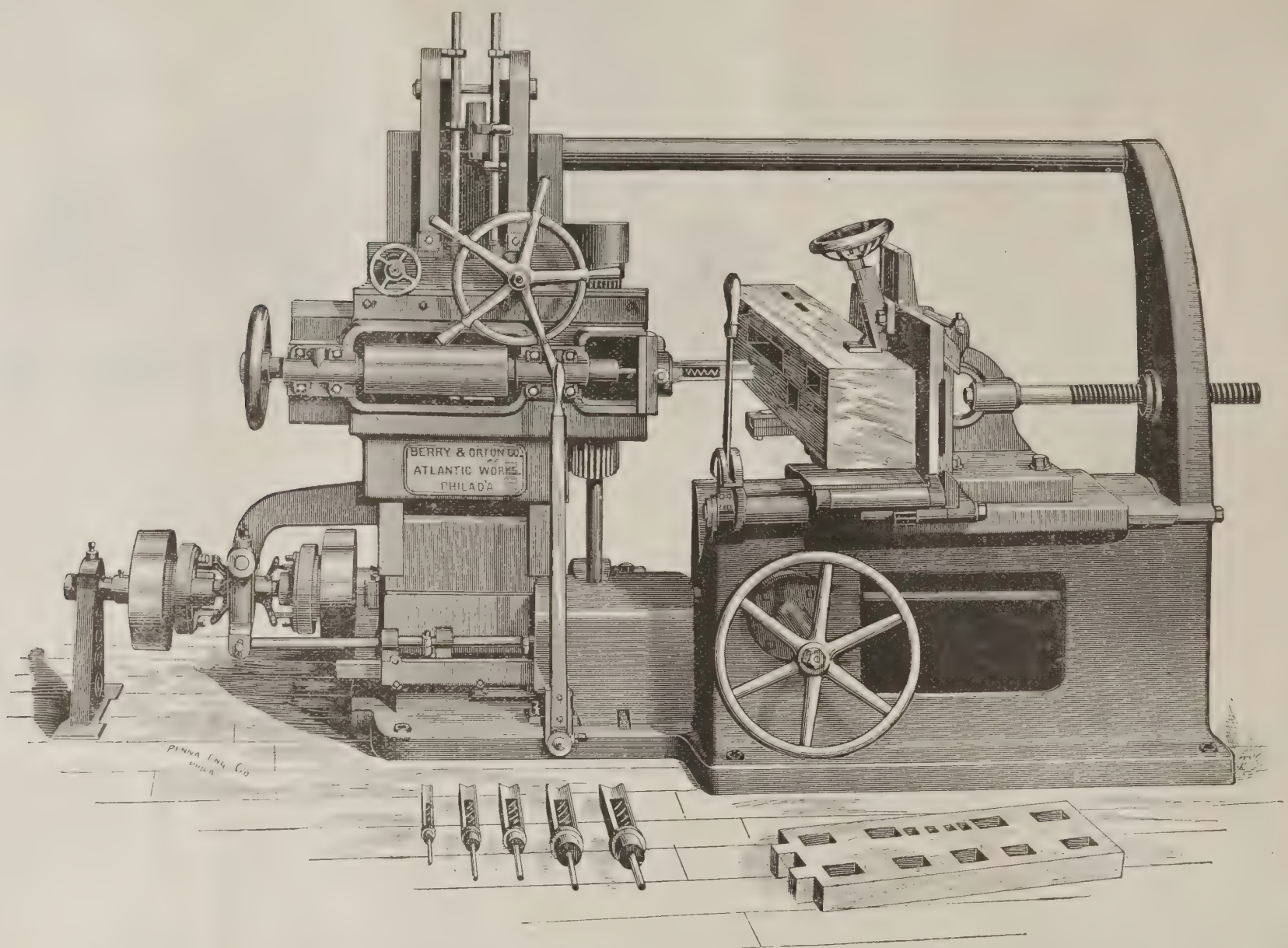
The Concord, N. H., Horse Railroad, who have voted to adopt electricity, have contracted with the Tripp Manufacturing Company, of Boston, for the celebrated Tripp anti-friction journal bearings, which will be furnished with trucks complete. These bearings are giving perfect success on various roads, and are rapidly coming into general use. The severe tests given these bearings have caused a vast amount of discussion, and their durability is no longer experimental.



AMERICAN DRAFT AND BUFFING APPARATUS.

In the annexed engravings is shown the latest form of the American draft and buffing apparatus. The merits of this device are well known to many of our readers, for it has been now applied to so many cars that nearly all railroad men are familiar with its operation. It will be seen from an inspection of the drawing that two draft springs are used at each end of the car. The spring directly behind the drawbar is the usual size, and requires about 16,000 pounds pressure to compress it fully. One great trouble with any ordinary draw gear in which but one spring is used, lies in the fact that many shocks far exceed the 16,000 pound limit of the spring and closing it up entirely, transmits the remainder of the blow to the car with nothing whatever to act as a cushion. The result is very disastrous to all of the draft rigging. In the gear we illustrate a second spring of 10,000 pounds capacity is added, thereby very much reducing the number and magnitude of uncushioned blows delivered to the draft gear. The tail bolt extends through both springs. The first spring is placed between the end of the drawbar and a follower plate which is backed up by drawbar stops. This follower is not a movable one, as the spring is always compressed by forces moving in the one direction, as will be seen later. The rear spring also bears against a similar fixed plate. A suitable washer and key in the tail bolt serve to compress this spring when the tail bolt is pushed back by the drawbar. The action is as follows: When the drawbar is in compression it compresses the large spring in the usual manner.

The head of the tail bolt being confined by the crossbar or yoke to which the drawrods are attached, the bolt is pushed in with the drawhead, thus compressing the second spring also, and thus resisting a force of 26,000 pounds before everything is brought up solid. Before the springs close entirely the yoke of the drawbar strikes in the bottom of the slots in the draft timbers in which they work. The facing on the inside of the draft timbers opposite the draft springs is made of 2 by ¾ in. iron, and the ends turned into the slots to form a seat for the yoke when it bottoms in the slots. When the drawhead is in tension, the strains are transmitted through the yoke and drawrods to the drawbar at the other end of the car, where the springs are compressed sufficiently to move the car. It will thus be seen that draft timbers, etc., meet compressive strains only, and that the pulling strains for the entire train are not transmitted through the timbers of those cars near the engine. This gear is owned and controlled by the American Continuous Drawbar Company, of Aurora, Ind.



HOLLOW CHISEL MORTISING MACHINE.

The accompanying illustration represents an extra heavy machine of new design, and will be found most useful for mortising in hard woods used in car building. The novelty of this machine consists in the peculiar formation of the chisel, which is square, and is fitted with an auger made to revolve inside it. The end of the auger projects slightly beyond the edges of the chisel, and when presented to the timber, it bores a round hole, the chisel following it and simultaneously squaring out the four corners and sides. Mortises of any length and width may be cut by forming a succession of square holes running into each other.

In placing this machine on the market the makers have made it a study, both in the design and arrangement of parts, to make it the most complete hollow chisel mortiser ever offered, and claim the following points of superiority over machines of other manufacture:

1. A much stronger, more substantial machine, and one less liable to get out of order.

2. Longer belts, which are more accessible, being all outside the framing of the machine.

3. The driving power for forcing the chisel into the wood is placed as nearly the center of the chisel as possible, which is from 6 inches to 10 inches nearer than on other machines.

4. The supporting of the timber to be acted upon is directly back of the table, and is in a direct line of the chisel.

5. The framing of the machine is such that the thrust while making the mortise is taken both above and below the chisel, hence the spring of the machine is reduced to the minimum, and the chisel, after being forced into the wood, is withdrawn with much more ease and less liability to break than when the strain is taken entirely below the chisel.

6. A double set of stops for regulating the position of mortises vertically.

7. A much cheaper and more durable machine.

The machine is built by Berry & Orton Company, Philadelphia, Pa.

The announcement is made that the business of the late firm of Drake & Wiers will be continued under the same firm name, Mrs. Wiers succeeding to the interest of her late husband for the benefit of herself and children.

The A. Wilhelm Company, Reading Paint Works, was lately incorporated with a paid up capital of $100,000. The new firm intimate that "the same care respecting excellence and uniformity of quality of our product will be maintained. You will find us abreast with the times in everything pertaining to the paint line."

The Timms Automatic Car Coupler Company, of Columbus, O., are manufacturing a patent journal box with a dust guard and end stop which they claim shows a saving in oil and brass of 50 per cent. over the ordinary boxes. They have a large number in use on the Columbus & Cincinnati Midland as well as on other roads.

The business of Byram & Co., of Detroit, manufacturers of cupolas, has increased very much; they have built and put up 75 cupolas during the past year.

The Pond Machine Tool Company, through its selling agents, Manning, Maxwell & Moore, 113 Liberty street, New York, have received an order from the Ordnance Department of the U. S. Government for 10 large lathes, for the work of turning, boring and finishing guns of 8 to 12 inches calibre. The contract amounts to $247,800. The time of delivery extends over a period of about three years, which enables the Pond Machine Tool Company to take care of its regular work promptly, and does not materially reduce the production of its shops for regular railroad and machine shop trade.

A press dispatch from Baltimore says: The Boyden Brake Company, of this city, yesterday filed suits in the United States Court against the Westinghouse Air Brake Company, the Northern Central Railway and the Western Maryland Railroad, alleging infringement of four claims on the Boyden patent for quick action triple-valve for automatic air brakes. The original date of this patent is June 26, 1883, and it is said to be the primary patent for the passage by which compressed air is transmitted from the trainpipe direct into the brake cylinder. It is said that all the new triple-valves used in the automatic air brake have this passage. Mr. Boyden claims that his invention of this feature precedes all others.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge of any error that may be noticed in our list.

Augusta, Gibson & Sandersville.—Major Hamilton Wilkens has been appointed general manager.

Baltimore & Ohio Southwestern.—John E. Rose has been appointed superintendent.

Burlington & Missouri River.—J. R. Phelan has been appointed superintendent of the Black Hills division, extending from Ravenna, Neb., to Newcastle, Wyo., with headquarters at Alliance, Neb. E. F. Highland succeeds J. R. Phelan as assistant superintendent on the Cheyenne line, with headquarters at Holyoke, Neb.

Central of Georgia.—D. D. Curran has been appointed Superintendent of the Savannah & Western division, with office at Columbus, Ga., to succeed W. J. Haylow, resigned. J. H. Averill succeeds Mr. Curran as superintendent of the South Carolina division, with office at Augusta, Ga.

Chesapeake & Ohio.—J. T. Harahan, general manager, has resigned, and the position has been abolished. Charles E. Doyle has been appointed superintendent of the Peninsula, Richmond and James River divisions, vice I. G. Rawn, resigned.

Chicago, Burlington & Quincy.—H. F. Hilton, superintendent of the Galesburg division, having resigned, E. M. Herr, superintendent of the St. Louis division, has been appointed to fill the vacancy, with office in Galesburg, Ill.

Chicago, Milwaukee & St Paul.—The following appointments have been made: D. L. Bush, to be superintendent of the Hastings & Dakota division, with office in Minneapolis, to succeed E. H. Graves, deceased. W. Irwin, superintendent of the Southern division, with headquarters at Austin, Minn., to succeed D. L. Bush, promoted. J. B. Cable, superintendent of the Iowa & Minnesota division, with office at Minneapolis, to succeed W. Irwin, promoted. James Gibson, assistant superintendent of the Iowa & Dakota division, with office at Mason City, Ia., to succeed J. B. Cable. promoted.

Chicago, Rock Island & Pacific.—Geoge F. Wilson has been appointed general master mechanic, with jurisdiction over all lines, and Harry Monkhouse is made his assistant.

Chicago, St. Paul & Kansas City.—J. Berlingett is appointed division superintendent of the Des Moines & St. Joseph division, with headquarters at Des Moines, Iowa, vice W. B. Scott, resigned.

Cincinnati, New Orleans & Texas Pacific.—F. C. Smith master mechanic, has resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—J. Q. Van Winkle, of the St. Louis division, is placed in charge of both the St. Louis and Indianapolis divisions, with headquarters at Indianapolis.

Galveston & Western.—William Davis has been appointed superintendent, with headquarters in Galveston, Tex.

Lake Shore & Michigan Southern.—J. E. Childs having resigned the position of assistant general manager, the duties pertaining to that office will hereafter devolve upon the general superintendent, P. P. Wright.

Michigan Central.—E. D. Bronner has been appointed master car builder of this company, with office at West Detroit, Mich.

Minneapolis, St. Paul & Sault Ste. Marie.—W. M. Kellie has been appointed to act as assistant to the general manager, with office in Minneapolis.

Moosilanke.—John H. Pearson, of Concord, N. H., has been elected president, and Ezra B. Mann superintendent.

New York, Lake Erie & Western.—Charles E. Fuller, Jr., has been appointed master mechanic, with office at Jersey City, vice G. W. West, resigned.

New York, Ontario & Western.—George W. West has been appointed superintendent of motive power, with his office at Middletown, N. Y.

Ohio, Indiana & Western.—W. J. Hayes has been appointed master car builder of the road, with headquarters at Indiana polis, Ind.

Pittsburg & Western.—H. C. Boughton has been appointed superintendent, with office at Allegheny, Pa.

Texas & Pacific.—Leroy Trice has been appointed superintendent of the Eastern Division, with headquarters at Marshall, Tex., to succeed John Bradley, resigned.

Toledo, St. Louis & Kansas City.—Charles Blackwell, superintendent, has resigned.

Tuscaloosa Belt.—W. C. Jennison has been elected president and G. P. Ayers superintendent.

NATIONAL CAR AND LOCOMOTIVE BUILDER

APRIL, 1890.

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The Colorado Midland is about to order 20 passenger cars.

The Chicago, Burlington & Quincy is in the market for about eighteen locomotives.

The South Carolina Railroad will have specifications out soon for ten new passenger cars.

The Northern Pacific Car shops at Cheney, Wash., are to be doubled in capacity at once. 1,000 men will then be employed.

The contract for building 1,000 ore cars for the Wisconsin Central has been let to the United States Rolling Stock Company.

The Brazilian government have recently had 40 passenger cars, consisting of sleepers and combination cars, built in this country.

The Union Pacific Company have determined to use iron brake beams in the future on all freight cars that carry more than 40,000 pounds load.

The Jackson & Sharp Co., of Wilmington, Del., has delivered two drawing-room cars, seating 24 persons each, to the Cincinnati, Wabash & Michigan.

A party of master mechanics and master car-builders went from St. Paul last month to visit the shops of the Minnesota Iron Car Company at Duluth.

The Pittsburg Locomotive Works have built five engines for the St. Louis, Vandalia & Terre Haute. The Baltimore & Ohio Railroad will add 30 locomotives to its equipment.

The Denver & Rio Grande has lately ordered 25 locomotives and 3,500 cars. This is to provide the necessary rolling stock for the standard gauge track which this company has formed.

The Rogers Locomotive Works have nearly completed two locomotives of an order for 26, of which 10 are to be passenger and 16 freight engines, for a narrow-gauge road in the Argentine Republic.

The Northern Pacific is now having built with Barney & Smith Co. 10 dining cars of an unusually handsome pattern, and 15 passenger coaches. Leather finish is used largely inside of these cars.

The Missouri Car Company, of St. Louis, Mo., has an order for 1,000 box cars, all fitted with air brakes, for the Chesapeake & Ohio. Also 1,000 box cars for the Cleveland, Cincinnati, Chicago & St. Louis.

The American Car Equipment Company has bought five acres of land at Clifton, N. J., on the New York, Lake Erie & Western, where it proposes to build a factory for the manufacture of cars and fittings.

J. G. Brill & Co., of Philadelphia, Pa., have delivered two passenger cars and one combination baggage and passenger car to the St. Augustine & North Beach. Also six passenger cars to a Mexican narrow-gauge road.

The stockholders of the St. Charles (Mo.) Car Company have elected the following directors: W. H. Glasgow, W. A. Hargadine, Estill McHenry, H. E. Machens, Henry B. Denker, William H. Markham and Henry Kister.

The Wason Manufacturing Company, of Springfield, Mass., is building six passengers for the Pike's Peak Railroad, and some passenger cars for the Brooklyn, Bath & West End ; 12 passenger cars have been built for the Maine Central.

The Lafayette Car Company will build the 1,000 box cars for the New York, Pennsylvania & Ohio at its Lima shops. The shops are working on 850 cars for this road, and also on orders for cars for the Cincinnati, Hamilton & Dayton, Lake Erie & Western and Pennsylvania.

The Minnesota Iron Car Company, of Duluth, Minn., will soon commence work on another order of 500 cars for the Iron Car Company. Of these, 200 box cars have been leased to the Cincinnati, Hamilton & Dayton, and the balance, 150 gondolas and 150 platform cars, have not yet been assigned.

Two fast passenger locomotives that were built two years ago by Mr. W. J. Robertson for the Central Vermont, have been running constantly ever since, making about 260 miles a day. They have not yet been in the shop, and have run with an unusually small call for running repairs.

In Scotland, recently, four workmen in a locomotive works were fined in the "Small Debt Court," before Sheriff Lees, for being absent without leave. The sheriff, in deciding, said the rules of the works were binding, and men must know that they could not come and go as suited themselves only.

Mr. Wm. Apps, master car builder of the Atlanta & West Point, has recently turned out of the Montgomery shops a suburban train that has attracted a great deal of attention. The cars are very handsomely finished, and special attention has been bestowed upon making the cars easy riding. Those who are using the cars speak enthusiastically about them.

The Canadian Pacific Company make the proud boast, so rare among large railroad companies, that they have never killed a passenger. They do not follow the example of the Cunard Steamship Company, and give that information as an excuse for all sorts of inconvenience and discomfort. They take a pride in furnishing the very best accommodation to their patrons.

The Brooks Locomotive Works, of Dunkirk, N. Y., have built two passenger engines for the Milwaukee Northern, and 10 engines for the New York, Chicago & St. Louis. They have begun the delivery of 25 locomotives ordered by the Cleveland, Cincinnati, Chicago & St. Louis. An order has lately been received for two new freight engines for the Cincinnati, Wabash & Michigan.

The Indianapolis Car Works, of Indianapolis, Ind., have completed 500 coal cars for the Pittsburgh & Western. They are now building cars for the Choctaw road, Indian Territory. Everything except the body is of iron. Each car is equipped with the Westinghouse air brake and the Janney coupler, and has a carrying capacity of 60,000 pounds. Fifty of these cars have been shipped. The works are to be enlarged.

Business must be prosperous with the New York Central Railroad Company these days, for they have lately given out contracts for the building of 40 switching locomotives and 6,000 freight cars. The heavy passenger engines built by the Schenectady Locomotive Works have been delivered, and are doing some preliminary freight work to make them ready for the fast heavy passenger service for which they are destined.

The Manchester Locomotive Works, of Manchester, N. H., have turned out a heavy passenger engine for the White Mountain Division of the Boston, Concord & Montreal. The engine has six driving wheels, 66 inches diameter; boiler, 53 to 59 inches, 10 feet 9 inches from rail to top of boiler, 14 feet 8 inches from rail to top of stack; weight, 60 tons. The works have recently received an order from the Boston & Maine for 20 locomotives of different kinds.

The Chicago, Milwaukee & St. Paul, having published a record of 280,000 miles made with a pair of wheels cast in a contracting chill, the Baltimore Wheel Company have answered with a card claiming a service of 400,000 miles for cast-iron wheels under fast passenger service. We are aware that properly made cast-iron wheels sometimes give a surprising mileage under favorable conditions, and we would like to receive figures from our readers of high mileage made that can be authenticated.

The Lehigh Valley Company is building 10 new parlor cars at their shops in South Easton. The cars are 60 feet in length, and 10 feet longer than those now in use. The seating capacity is 27 chairs. A smoking department is a new feature, and will accommodate 10 passengers. A divan is also a new acquisition, and is to be used in cases of sickness. A curtain festooned at the ceiling is so arranged that it can be dropped to conceal any sick person from the other passengers. The interiors are fitted up in antique oak. The cost of the 10 cars will be $100,000.

We have received from the Westinghouse Air Brake Company a neat pamphlet containing exhaustive articles with map and tables published by the *Engineering News* describing and illustrating in a striking and graphic manner the progress of the adoption of the air brakes and automatic couplers. The pamphlet, which is very artistically gotten out, puts in permanent form very able articles that represent a great deal of intelligent labor and which deserve more than the transient notice secured by appearing once in the columns of a journal.

At a recent exhibition of the London Mechanical and Scientific Society a great many interesting instrument were exhibited to illustrate the remarkable progress of the mechanical arts. Among other things that at first attracted much attention was a measuring instrument made by the Armstrong Gun Works, which accurately measured thickness down to one-thousandth of an inch. But this instrument was put badly in the shade by one exhibited by a working mechanic, which was capable of measuring grades of thicknesses in millionth parts of an inch.

The Seattle, Lake Shore & Eastern has received three passenger and two combination baggage and smoking cars from the Pullman Car Company. These cars are part of the order placed about three months ago, which included 40 platform, 10 box, 20 coal dump cars and the passenger and baggage cars just received. All but three of the platform cars have been received and the box cars are on the way. The company has ordered wheels and trucks for 30 logging cars from the Peninsular Car Company, of Detroit, Mich., which has built most of the freight equipment for the line.

The Chicago, Rock Island & Pacific road has issued a circular to employés which reads as follows: Persons known to be in the habit of becoming intoxicated must not be taken into the service of this company. Station agents, yard, train and engine men, telegraph operators, clerks and others who are known to frequent drinking places should be warned that they must stop it at once if they desire to remain in the service of this company. If known to have been intoxicated either on or off duty they will be discharged. No person discharged for intoxication shall be re-employed.

The Baldwin Locomotive Works have recently built for the Mexican Central five Mason-Fairlie locomotives with three pair of coupled drivers. Four other heavy locomotives have been received by the company recently and three more are now building. The works have an order for 7 ten-wheel engines, with cylinders 20x24 inches, for the New York, Pennsylvania & Ohio. They will be similar to the engines now in use on the New York, Lake Erie & Western. The works are also building 8 switch engines for the Merchants' Bridge, St. Louis, and a small engine for the Maule Coal Co., of Belleville, Ill.

During a recent journey the writer happened to see a bad railroad wreck caused by a wash out of the track. Many freight cars were badly damaged, and as the greater part of the cars were heavily loaded the frames and sides got badly fractured by the sudden severe strains put upon them. There was one interesting exception to this. A box car with an iron tubular frame of the kind built by the New York Iron Car Company was thrown in such a position that more than half of the car was hanging over an opening without any support. The car was heavily loaded with barrels of cement, yet it stood the tremendous strains without the least sagging of the frame or sign of yielding.

The Schenectady Locomotive Works are reported to be unusually busy, with the prospects of a good season for work. They have recently received orders for 40 switching engines and a large number of freight locomotives for the New York Central. They have also received an important order from the East Tennessee, Virginia & Georgia, which includes two compound locomotives, one for passenger and the other for freight service. The works have lately completed ten 21 × 24-inch 65-ton consolidation freight for the Chesapeake & Ohio; five 20 × 24-inch 60-ton consolidation freight for the Fall Brook Coal Company; two 18 × 24-inch six-wheel switching for the Houston & Texas Central; one 18 × 24-inch six-wheel switching for the Elizabeth, Lexington & Big Sandy; three 18 × 24-inch ten-wheel freight for the Kentucky Central; one 18 × 24-inch ten-wheeler for the Ohio & Big Sandy, and two 17 × 24-inch six-wheel switchers for the Chicago & Northwestern.

A car repairer on the Missouri Pacific, having been injured while repairing cars through the failure of his foreman to prevent the car from being struck, a verdict for damages was obtained in a district court and the railroad company appealed to the Supreme Court. The decision of that court held the company responsible. The court stated that where a laborer employed in the repair department of railway shops is required, in the course of his employment, to go under a car, his foreman agreed to watch and see that he was not injured. There was evidence that plaintiff also asked a yardman to keep a lookout, and that the foreman relaxed his vigilance, and plaintiff was injured by being ducked down upon by a yard engine. It is held that notwithstanding plaintiff's request of the yardman, he is still entitled to rely on the agreement of the foreman to protect him, and the foreman, being the representative of the company, and not a fellow-servant, bound the company by his negligence, and rendered the defendant liable for the injury to plaintiff.

EDITORIAL CORRESPONDENCE.

A Southern Tour.

The uncertainty about the prospects of the Lookout Mountain Hotel, at Chattanooga, being ready in time for the accommodation of the Railway Master Mechanics' Convention, urged that the writer should make a personal inspection of the place. Bent on that mission, he found himself at Pittsburgh early in the month, and while remaining over for a few days, availed himself of the opportunity to pay a long promised visit to

THE UNION SWITCH AND SIGNAL WORKS.

These works are situated at Swissvale, a few miles outside of Pittsburgh, and are well worthy of a visit. A weak point in the business armor of nearly all railroad officers is ignorance of first-class signaling systems. Where the necessity for the introduction of a perfected system of signals has become urgent it is a very common thing to hear the officers, responsible for the procrastination that retains dangerous crudities, talk as if an automatic signaling system was nothing better than a costly plaything. When they are crowded to explain on what their conviction rests they ambiguously confess that they do not understand anything about signals. I know of no better way of dispelling this cloud of ignorance than by spending a day in a signal tower of some railroad that has introduced a good signal system, or by paying a visit to the Union Switch and Signal Company's works. The experience in either place will give an object lesson worth a world of recommendations.

To a mechanical man a visit to these works reveals considerably more than an insight into the best and most improved forms of signal and switch interlocking apparatus. It shows him the inside working of a remarkably well conducted manufacturing establishment, where a system of producing interchangeable parts at the lowest possible cost is carried to the farthest limit. A station signal does not appear to be an intricate apparatus, and on a superficial examination it looks as if the parts constituting the appliances and connections of a signal tower were not numerous, yet close inspection will show that the details and different forms of parts constitute an immense variety, and the manufacture of this variety has given the managers of the Union Switch and Signal Company's works scope for displaying more than ordinary mechanical ability.

The general plan of production and the details of the work are all carried out with marked ability. All the work originates in a system of orders, which are sent from the office to the shops, each foreman receiving a copy of the order. This forms the directions to each individual foreman to proceed with the work that his department has to furnish. As the parts to be made are generally repetitions of previous productions the operations go on like clock work. Each foreman appears to be held responsible for the accellerating of manufacture, and he is provided with the most approved machinery for aiding him in the work, and all concerned are encouraged to devise improved tools and expeditious methods for lessening the cost of production. This policy has led to the invention of numerous special tools, many of them being highly ingenious. One of the finest special tools that I have ever examined was designed by one of the company's engineers and built in the works. The purpose of the tool is the turning of pins, large quantities of which are used in the establishment. It looks like a six-headed gang drill, but the motion is transmitted below. The upper spindle has a vertical movement for releasing, to put in or take out the work. The lower head has movable jaws which take hold of the pin and keep it in position for turning, which is done by cutters secured in the lower part of the spindle. I would respectfully direct the attention of tool makers to this machine.

To judge from the number of Westinghouse friction buffers that these works are turning out, I should conclude that there is already a good demand for that very valuable draw-gear attachment. They have several special tools at work producing the various parts of this buffer.

My space will not permit me to attempt a description of the details of the work going on; suffice it to say that the diversity of manufacturing operations is surprisingly great. There is the Saxby & Farmer interlocking apparatus, a variety of signals, semaphore, disk, crossing, etc.; electric and pneumatic appliances for operating signals and switches, automatic brake setting attachments, apparatus for block signaling, frogs, switches, switch stands and targets, crossings and slip switches, and many other things used in connection with railroad machinery. It seems a puzzle how this diversity of work can be carried on so successfully in one establishment, but the system appears to embrace the whole as easily as it would one operation.

In one part of the works they have tracks, switches and signals arranged for the purpose of showing the operation of the apparatus in service. A very interesting part of this is where the working of the rail circuit signaling system is shown. Miniature cars are moved over the rails, and when they enter upon the block the signals are put to danger, and returned to line clear again when the block is passed. There are very few establishments where a railroad man could spend a more profitable day.

IN CINCINNATI.

My next stop was at Cincinnati, and a couple of days merely afforded a glimpse of the interesting things to be seen in and around that city. I was able for a short time to ramble through the great lumber piles and warehouses of Albro & Co., where large quantities of the veneers are made that find their way into car decoration. Some of the mahogany to be seen in these warehouses brings a visitor more within the portals of art than what generally belongs to the domain of raw material.

KENTUCKY CENTRAL SHOPS.

Across the Ohio from Cincinnati is the old town of Covington. In the outskirts of this pleasant and rapidly growing city the Kentucky Central are erecting new shops for the repairs of cars and locomotives. The work is progressing under the supervision of the very energetic master mechanic, Mr. S. R. Tuggle, and they are progressing rapidly. Mr. Tuggle has enjoyed the good fortune of having the shops built to suit his own ideas, and I feel sure that when they are finished there will be no more convenient shops found in the country. The buildings are of brick, one story high, resting on a solid foundation of stone, and covered with a combination iron and wood truss roof. The shops are all well lighted all round, and have in addition skylights in the roof. The buildings are arranged on the parallel plan, with transfer table for taking locomotives and cars to their respective shops. The buildings are so situated that there is track access to them on both sides.

The tools are all new and are of the most popular types and makes. Although the tools were not into the shops when I was there, a diagram of their location showed that great care had been exercised to place them in such a way that work and material could be handled to the best advantage. Before settling the location of the tools Mr. Tuggle visited many of the best shops in the country, and considered all the advantages and disadvantages of the most approved way of setting tools. He has done his best to profit by all that he had seen.

The roundhouse is notable for the length of the stalls, which are 75 feet long within walls. It will take something more than a 56½-inch gauge of track to encourage the building of locomotives too long for this roundhouse. The pits are built of brick, with the middle higher than the sides, which gives the workmen dry footing. The turntable is 60 feet long and rests on a very substantial stone foundation.

In the course of a brief visit to the Chesapeake & Ohio shops at Covington, I found Mr. T. S. Lloyd, the master mechanic, full of schemes for making a particularly inconvenient shop capable of turning out work expeditiously. The main shop is a fine brick building that from the outside looks quite a representative of modern ideas. But on getting inside we find that it has been planned something after the European style, without the facilities that make foreign shops fairly convenient. The engines to be repaired are set on a single track running lengthwise of the building, the machine tools being set at the sides. The tools are badly situated for the sequence of work, and when the first engine put in is ready for coming out the others have to be moved out of the way. A transfer table inside the house is used for taking the engines away from the repair track. With the exception of the Delaware, Lackawanna & Western shops at Buffalo, I have not seen a more inconvenient shop of modern build than that belonging to the Chesapeake & Ohio at Covington.

WORK IN CINCINNATI SOUTHERN SHOPS.

The most noteworthy thing I found about the shops belonging to the Cincinnati, New Orleans & Texas Pacific, at Ludlow, Ky., which is also across the river from Cincinnati, was the small number of men employed in doing the manufacturing work necessary to keep 190 locomotives and 9,000 cars in running order, besides doing all the running and general repairs on 120 locomotives. Mr. James Meehan, superintendent of motive power, gives the work very close personal attention and all his assistants appear to be very well selected.

I found Mr. Sullivan, the general foreman, devoting every minute he could spare from other duties to the devising of jigs and labor-saving devices. The shop is already exceptionally well provided with templates and other devices for securing the interchangeability of parts, yet they are still extending this means of maintaining uniformity.

They do a great deal of work by grinding, and find that the emery wheel is one of the best paying tools in the shop. Their grinding room is partitioned off from the main shop, and contains a good plant of grinding and buffing machines. A great part of the work is thus finished from the rough forgings. The chief grinder is exceptionally expert at his work. I saw him take the rough casting of an injector check valve and finish it in three minutes. He cleaned it up and put a beautiful polish upon it in that time, and left it ready for use. They finish up nuts and bolt-heads here from the rough, and make them fit the standard gauge.

Turret lathes are employed to good advantage in this shop. I watched a man making rod cups on one of them. He took the rough casting and bored it out, cut the top thread, and screwed in an iron feeder in two and a half minutes. This, of course, was a rush job, but it shows what can be done and the tendency toward pushing work. As the men are working on piece work the chances are that they do not fall asleep over their tools.

They have a kind of hand tool plan of piecing flues here that turns out a great deal of work. By following it two men can cut, scarf and weld two hundred flues a day. The cutting tool used is of a peculiar shape, and it leaves flue and piece partly scarfed. The piece is dropped into a holder, and one blow given to a swedge inserted in the end scarfs it. Another form of swedge is driven into the flue and it is ready for welding.

They are using steel axle boxes very successfully on the Cincinnati Southern. The only extra provision made with them is putting a brass liner on the hub of the wheel. Mr. Meehan says that brass makes a more successful liner for a steel box than cast iron. He is also using brass driving boxes successfully, but special care has to be exercised in the casting of these. He uses a mixture of six of copper to one of tin, and employs a lead flux. The latter practice he regards of the greatest importance. When zinc was used for this purpose the castings were so brittle that they could not be safely used.

Some of the engines have got the reservoir exhaust pipe similar to that used on the Kansas City, Fort Scott & Gulf, which was illustrated in the National Car and Locomotive Builder last month. It is very highly spoken of by the men running the engines, and is likely to be extensively used on the road.

IN CHATTANOOGA.

This famous city has been making wonderful material progress of late years, but its attractions for a man looking out for grist for the mill of a railroad mechanical journal are by no means numerous. The scenes around are, however, of transcendent interest to the student of history and to every one having an eye for the beautiful in nature.

My first attention was naturally directed to finding out the exact condition of the new hotel under construction at the top of Lookout Mountain. The giddy height is comfortably scaled by a standard gauge railroad, which winds around the cliffs and crags on this historic mountain and finally lands the passengers in front of the hotel. This is an immense structure and will be capable of providing accommodation for twice the number of persons that attend the conventions, but the work is still in such a backward condition that the Executive Committee did not deem it wise to depend upon its being ready in time. Those who attend the Railway Master Mechanics' convention have good reason to regret that it is impracticable to hold the meeting at Lookout Mountain hotel. The attractions around are unparalleled as far as summer resorts are concerned. The scenery is magnificent and the points of interest in the neighborhood are so numerous that all those who had time for sight-seeing would have found attractions such as no other part of the country could rival.

There is a moribund car-building establishment in Chattanooga, but even with the local advantages of cheap lumber and iron, it cannot compete with other works that have progressed with the times and introduced improved methods of manufacture, aided by the most improved machinery. The proprietors, however, talk of putting in improved machinery and making their works equal to the best. There are several prosperous forges in and around the city, but the only establishment which I saw likely to interest railroad men was the

ROSS-MEEHAN BRAKE SHOE FOUNDRY.

That shop has only been running about a year, but it has worked up a wonderful business in that time, and is now casting 200 tons of iron a month. They do not by any means confine themselves to brake shoes, although that is their staple article of production. The place is doing all sorts of foundry work and is turning out large castings that would be a credit to any foundry in the North. The building of this foundry seems to have been the filling of a want that existed, but was not very apparent, for the promoters of the enterprise were by no means certain that it would be a success at first. Yet business has been so good from the start that they had to extend the building, and they are now preparing to extend it again.

DECATUR CAR WORKS.

A run of five hours over the Memphis division of the East Tennessee, Virginia & Georgia brought me to Decatur, Ala., one of the greatly boomed Southern towns, and a lively place, which might have been more prosperous still had it not been spread over half a county by the action of town lot speculators. The attractions of this point were the car works belonging to the United States Rolling Stock Company recently built here. They are very well built works, equipped with excellent machinery, and situated in a region where lumber and iron are cheap. The facilities provided for doing the work are as good as anything to be found in the North, and material is decidedly cheaper, so there is no fear that these works will not succeed in securing a good share of the work in building the freight cars for Southern railroads. They are building about ten cars a day, and have facilities for about double that number, but there appears to be a temporary scarcity of timber, which is keeping back the work. They were putting on fine poplar as sheathing of cars to keep the men going, although it cost about twice the money pine could have been bought for at that place.

They were building some very heavy coal hopper cars for the Georgia Pacific, and all the other work around had the stencil of the Southern roads.

The most noteworthy department of the works to me was the blacksmith shop, where a past pupil of my own is foreman. Among the pupils who attended a night school run for one winter in connection with the Burlington, Cedar Rapids & Northern shops, was a blacksmith named Edwards. That man is now foreman of the blacksmith

shops of the Decatur Car Works, and he is an enthusiast on formers and labor saving devices. Some of his attachments for the bulldozer were the most ingenious I have ever seen.

LOUISVILLE & NASHVILLE SHOPS.

I was aware that the Louisville & Nashville Railroad Company erected locomotive and car repairing shops at Decatur some years ago, but I was not prepared to expect the handsome establishment which I found in charge of Mr. A. Beckert, master mechanic. Cleanliness or tidiness is not a strong point about Southern manufacturing establishments, shops or factories, but the Louisville & Nashville shops are as orderly and cleanly in every respect as anything I have ever seen. The shops are very extensive and are within an inclosure that takes in 57 acres. There is the greatest possible contrast between the inside and outside of the inclosure fence. Outside all is roughness, dirt and slovenliness; inside all is finish, cleanliness and neatness. I should think it would do the ordinary denizen of Alabama good to go occasionally and gaze through the fence at the signs of industry's victories which prevail around the Louisville & Nashville shops.

The buildings are of brick, very substantially constructed, and well arranged for carrying on work. The inclosed yard is traversed by several tracks, and the locomotive shops are located on one side and the car shops on the other. All the shops are readily reached by the tracks for putting in or taking out engines and cars. The various shops are equipped with first-class tools, and the work is turned out as quickly and as well done as anything seen in the North. As far as my experience goes these are the finest railway shops in the South, and very few Northern shops are equal to them in the character of the buildings, the kind and arrangement of tools, and in the system of production that is followed.

IN BIRMINGHAM, ALA.

If you propose going to Birmingham you are certain to be informed that it is the most wonderful city in the South. If you happen to mess around its unpaved suburbs for a day or two, when it has rained as if the flood had come, and you have stuck in the mire in numerous attempts to ford profound street crossings, you will be disposed to conclude that Birmingham agrees with the drummer's opinion of Paradise when he found there was no whisky there. Birmingham is an extraordinary city, but the crudity of its surroundings is appalling. It would be much more attractive if one could see something that appeared finished. There is rather too much confusion around for a man of settled habits. Still, the growth of the place has been extraordinary, and the city in the near future is destined to be the center of a great and teeming population supported by the great mineral riches that abound in the surrounding region. At present, however, the place is not half so attractive nor are its future prospects one-tenth of what they are reported to be by property speculators.

AFFAIRS IN THE SOUTH.

All over the districts where my journey extended there were evidences of a lively shaking up of the dry bones of old contentment ways, and signs that ambition had roused a great part of the population into active industrial habits. Many parts of the South to-day resemble the Western country in the years when railroad extension frenzies were raging. There is great inflation of values and wild anticipations of coming greatness in every hamlet having in the district a coal seam or iron ore formation, but that spirit is already settling down.

We have been hearing a great deal lately about the South being greatly in want of capital to help in developing the natural resources of the country, but from what I saw or heard I concluded that skilled labor was more needed than anything else. Men in charge of works repeatedly complained about the difficulty of obtaining and retaining good mechanics and reliable men for taking the lead in operations. Men who are otherwise intelligent have benighted views about the training required to produce competent men for certain work. In one city where they had put in operation a fine electric lighting plant they have a locomotive engineer in charge, and he started out by destroying the commutators and almost ruining a fine high-speed engine. But the leading men of the town argued that a man who knew how to handle a locomotive pulling a fast passenger train must necessarily have skill enough to manage an electrical plant.

A gentleman who is running with financial success a small manufacturing establishment has a curious way of making steam for his engine. He has an old double flue boiler of the Lancashire type, which he fills with water through the manhole in the morning. He uses this water as long as it lasts, and when it gets nearly dry he opens up the manhole again and fills the boiler as full as it will hold. On being advised to use a pump he replied that it was much the better and natural way to fill the boiler choke up and let her boil.

Another man in the same town uses an inspirator to feed his boiler. In summer when the feed water gets a little warm the inspirator will not work easily, so he overcomes this difficulty by keeping a supply of ice in the feed water. He says the inspirator soon lets him know when the feed water is getting too warm to be wholesome.

A gentleman of color had been using a small portable engine in a business he was carrying on, and lately he sold the engine to a neighbor who was not very well posted about steam using. The colored man volunteered his assistance as instructor. While he was still giving the buyer's men the benefit of his engineering attainments, the steam gauge ran up to nearly 100 pounds. On noticing this the darkey exclaimed: "For de Lawd's sake you mustn't let de steam go so high. I'se got a strif-a-cat saying that she mustn't succeed 80 pounds bullock pressure."

One hears a great many funny anecdotes emphasizing more than anything else the fact that good mechanics would find in the Southern States a lucrative market for their labor. I must postpone till next month the remainder of my notes about the Southern tour. A. S.

Signaling and Interlocking.

At the last meeting of the Illinois Society of Engineers Mr. Charles Hansel, consulting engineer of the Illinois Railroad & Warehouse Commissioners, read a paper on the above subject. He mentioned what had been done by the State of Illinois to encourage the use of interlocking signals and switches, and described the systems in use.

There is, said he, a great deal of uniformity in design and government of signals intended for like duties. As now used, each railroad has a different code, one often being essentially conflicting with the other. With most of the codes now used the manner of signaling changes at sunset and sunrise; by day, form of signal governs; by night, the color of light is the only guide. Form should govern by night as well as by day. This feature should be made a part of all signals; it is an element of safety vital in its results. Too much stress cannot be laid upon the importance of a position signal. Form is easily distinguished when color is not discernible even by the keenest eye, and many of our most careful engineers cannot determine color who could easily determine form. All signals should show a form for safety as well as danger. It is the practice on some railroads to indicate but one position, and that for danger. Is it not apparent, that if but one form of signal is used it should display at safety? For should the signal be destroyed the signal to advance would not appear and the train must stop for safety signal to be shown; whereas, if position is given for danger only, and the switch be displaced and signal destroyed, no signal of danger appearing, the engineman would proceed and bring destruction to his train.

I think the use of the torpedo is misapplied on many roads; for instance, rule as follows: Explosion of one torpedo, proceed under control; explosion of second torpedo, stop, danger. Let us suppose the second torpedo does not explode as intended, or perhaps is displaced, then, under the rule, enginemen would proceed to danger when he should stop. The torpedo should be used as follows: Explosion of one torpedo, apply brakes to stop; explosion of second torpedo, proceed at caution, train under control. This would provide against the fault of the first rule mentioned, which is now in use on some roads.

Station order boards should give two forms, as well as all other signals. Trainmen should be provided with a book, of convenient size, in which is shown the position of signals to be used on engines and cars under each movement of train possible under the rule, also form and use of all signals to which their attention is called while running. Each diagram should be followed by a short rule, so plain and direct as to make it impossible to misconstrue its meaning.

The question of the adoption of a uniform code of signals has been the subject of much debate among thinking men who are charged with the safe government of the transportation of persons and property. The rapid advance in the perfection of signals adds to the difficulty of determining upon a system which should be adopted as a universal standard. This fact should not deter us from investigating the best appliances known to science, and adopting the most efficient. To this end I would suggest that a congress be called by the railroad managers, each company to be represented by a person conversant with the methods of signaling in use on the line he represents. A careful consideration of all methods would enable this congress to select the most efficient, and complete a code which should be the accepted code on all railroads. This congress should be permanently organized, and annual meetings held to consider any new devices that may be offered for the improvement of the code.

Freight Car Couplers.

At the March meeting of the New England Railroad Club the subject of Freight Car Couplers was discussed.

Mr. Curtis intimated that the Executive Committee sent out a circular seeking to obtain an opinion on the different forms of coupler from the men in the New England States who have most to do in using them. The vote recorded is as follows: Safford, 1,239; Janney, 587; old-fashioned link and pin, 63; Boston automatic, 30; Miller, 25; Gould, 20; Marks, 5; Dowling, 2; Cowell, 1. The committee wished it to be understood that only two types of coupler were to be discussed, viz., the Safford, or the link and pin, and the Janney, or the vertical plane type.

Mr. F. D. Adams, Boston & Albany, gave some particulars of his company's experience with the Ames coupler, and said that his faith in the coupler has never been shaken. The company had, however, abandoned the Ames and adopted the Safford, which the trainmen nearly all endorse; had watched closely the behavior of the M. C. B. type of coupler, and had a careful record kept of the breakages of all couplers. Out of 606 breakages reported 337 were of the vertical plane type of coupler. Yet he did not believe that more than two per cent. of the cars handled had on this kind of coupler. This had turned him in favor of the Safford, and they were putting it on all their new cars. Held that Mr. Wall, the prime mover in favor of the vertical hook, did not want to use the type himself. One thousand cars had lately been built for the Pennsylvania lines west of Pittsburg, and they all had the old style coupler. Now, he continued, I want to ask, if the Pennsylvania road and their employés are all of them so strongly in favor of this vertical hook, why they don't use them instead of building 2,000 or 3,000 cars of the old style. The Missouri Pacific have equipped but 100 cars with this type and have built 2,700 with the link and pin coupler. The Atchison, Topeka & Santa Fe have abandoned this coupler absolutely, are now replacing it with the Safford automatic, and they are putting the latter on all the new cars.

Mr. J. W. Marden, Fitchburg, admitted that he had never been a believer in the vertical plane coupler, and was not yet prepared to accept it, although he was very anxious to see some form of uniform safety coupler adopted. Our experience, he said, has been similar to that of Mr. Adams. We have had but a very small percentage of cars over our road equipped with the vertical plane coupler. We have had built 100 cars, and had them equipped with the Master Car-Builders' type. Our experience with that 100 cars has been very expensive. Our car accountant has told me that since those cars were put in service, at least up to within six months, they were out of service at least 50 per cent. of the time on account of having disabled bars, broken couplers, etc., and that, added to the expense of taking them to the shops or to a place where we could apply either the knuckle or coupler, and making the changes, has been rather an expensive operation for us. And I do not believe to-day that if a majority of those who are now using the Master Car-Builders' type of coupler were to honestly express their opinion, they would say that they thought that the Master Car-Builders' type was just what the railroads need to-day, and if they did express an opinion, they would say, in my opinion, that it was a very expensive coupler for railroads to use to any great extent. As to what the coupler ought to be, or as to what the road that I am connected with would adopt, I am not prepared to say to-night. I will say, however, that we are equipping the cars that we are now building and repairing with what is known as the Perry automatic coupler, which we have used for several years. I have no doubt but what we shall use later on some of the Safford bars.

Mr. T. W. Getman said that where the cars equipped with the vertical plane coupler were kept running together, the proportion of breakages as much smaller than where they were mixed up with cars having on all kinds of drawheads.

Mr. Lauder referred to the wide difference in the proportion of breakages of M. C. B. type of couplers reported by different roads. An explanation of this was that some of the roads using this coupler had put it on special lines of cars that were kept together and were not subjected to the rough usage undergone by cars in all kinds of service. He knew that the couplers of the Janney type were subjected to very severe usage in the Boston yards and the small number in use made the service all the harder. But he believed that as the number of this kind of coupler was increased the proportion of breakages would be diminished. Yet he anticipated nothing but disaster to these couplers when put into rough-and-tumble work even if the type was generally adopted.

The Michigan Central Railroad is making an important change in the color of its cars. For a number of years past the passenger coaches on the road have been painted a bright yellow, and this was found to very quickly change its color under the influence of weather added to dust and dirt. The color chosen is a very dark brown with trimmings of gold.

There is under construction at Pullman a gospel car contracted for by Bishop Walker, of North Dakota. The car will have a seating capacity for eighty persons, and will be provided with pulpit, robing room and baptismal font. The car will be taken from place to place in the barren region where Bishop Walker's diocese extends, and confirmation services will be conducted in it wherever a congregation can be collected together. It will be very luxuriously fitted up, and handsomely furnished inside.

Experiments which have been made recently on the Austrian state railroads, with wheel tires of Krupp's crucible cast-steel and Martin steel, have yielded interesting results. For the purpose of the trials, three wheels on one side of a locomotive were furnished with tires of one kind of steel, and those on the other side with tires of the second kind. The profiles, to start with, were, of course, exactly alike. After two years' running, measurements of the profiles showed that the Krupp steel tires had worn down on an average 10 millimeters (about 0.4 in.) while the Martin steel tires had worn down 14 millimeters (about 0.56 in.). Including the weight of the metal removed in again turning down the tires to the normal profile, the weight lost, due to wear, was 40.4 kilograms (88.88 lbs.) in the case of Krupp tires, and 56.4 kilograms (124.08 lbs.) in the case of those of Martin steel.

A New South Wales paper says: "It is believed that the Railway Commissioners are of opinion that the adoption of a uniform gauge for the whole of the colonies would involve the application of the same type of brake for the rolling stock on all the intercolonial lines. When the Commissioners were first requested to send an expert to Adelaide to witness a demonstration of the capabilities of the Westinghouse and vacuum brakes, they came to the conclusion that, instead of one colony making such an investigation as that proposed, it would be better if the whole of the colonies should jointly undertake it. As, however, the South Australian Government seem anxious to have their proposal carried out, it is not improbable that the Commissioners for this colony will acquiesce in the desire of that government by sending to witness the trial of brakes Mr. D. H. Neale, mechanical engineer."

Railway Car Construction.

BY WILLIAM VOSS.

Seventeenth Paper.

PLATFORMS AND COUPLERS.

Originally the same drawbars or couplers and the method of attaching them to the body, then as now used for freight cars, was employed for passenger cars also. Close couplers were at that time not known, and something to prevent the unpleasant jerking in starting and stopping was very much needed; the fact also that the evil effects resulting from buffing below the line of the floor timbers are multiplied by placing the point of contact of two coupled cars a distance of some three feet, or the width of the platform, beyond the end framing of the car, and to such an extent that this was the principal cause of telescoping in a collision, called for an improved and more substantial construction.

As the remedies or substitutes are eventually always forthcoming after the need of them has become apparent, so have they in this instance. The invention of the Miller and Janney couplers, buffers and platforms, the latter the most perfect, because it is more modern, must be classed with the few great improvements in car construction of the age. When the gear is properly adjusted and the engineer handles his train with ordinary care, no violent shocks are possible, as there is no loose slack between the cars, both the drawbar and the buffer springs being under compression at all times. Telescoping is practically impossible to-day, and when it does occur can generally always be traced to mixed couplers, or to the connection between the first car and the tender, which is usually made with an ordinary link, and even where the apparatus designed for this purpose is provided, is not as secure as the connection between the cars, principally because the sills of the tender are seldom on the same level with those of the cars or platforms. We can recall a number of instances where in a collision this connection was the only one to fail in the train, and several where telescoping and loss of life resulted from placing a car equipped with the Janney couplers in or near the middle of a train fitted with Miller hooks. The coupling was, of necessity, accomplished with a link, which broke when the shock came, and allowed this car, the platform of which happened to be several inches higher, to mount and enter the adjoining car. If all of the cars had been equipped either with Janney or Miller couplers, no damage beyond that sustained by the engines would have occurred; the cars in the other train, which was also an express, but had no mixed couplers, were not injured.

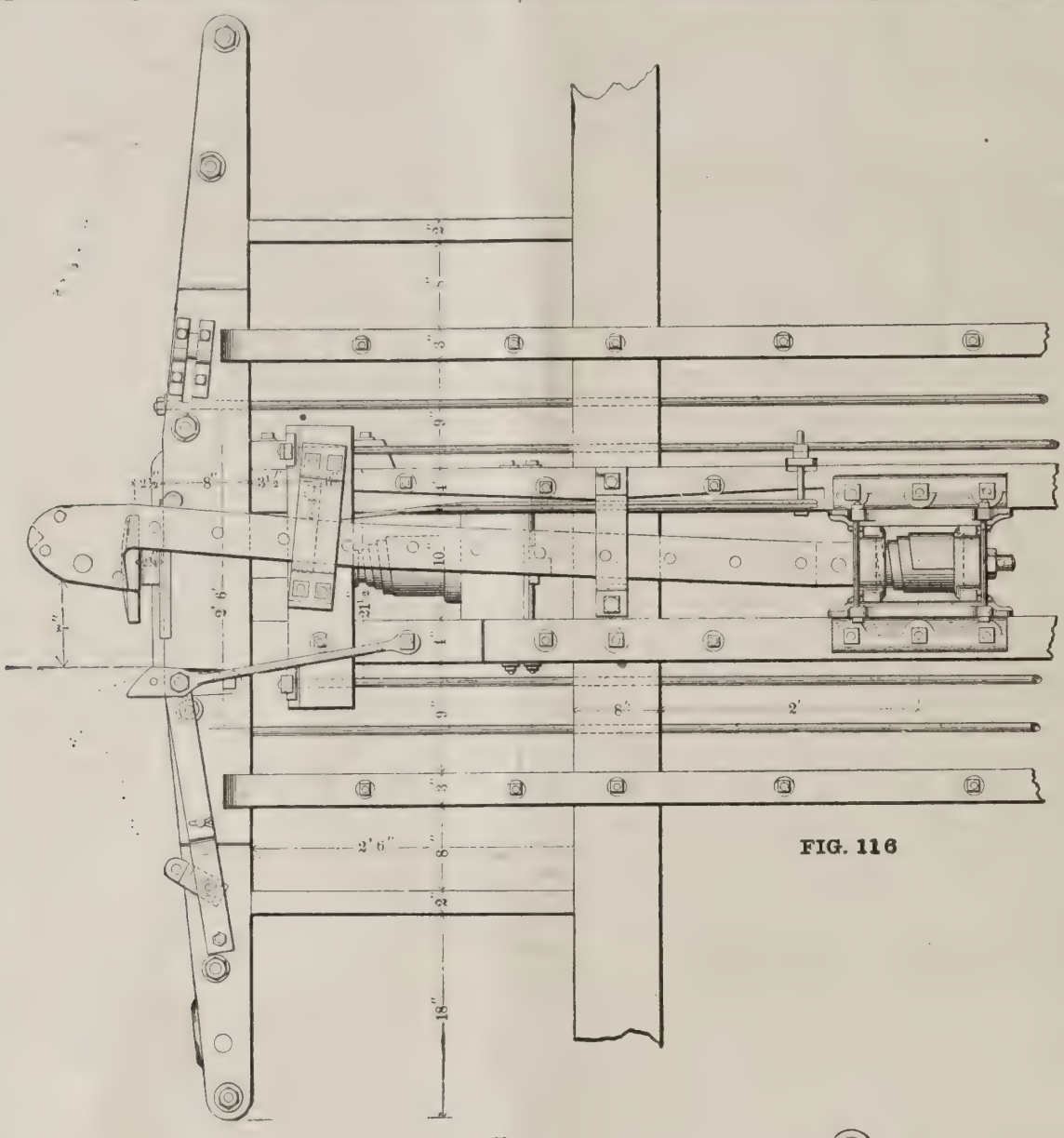


FIG. 116

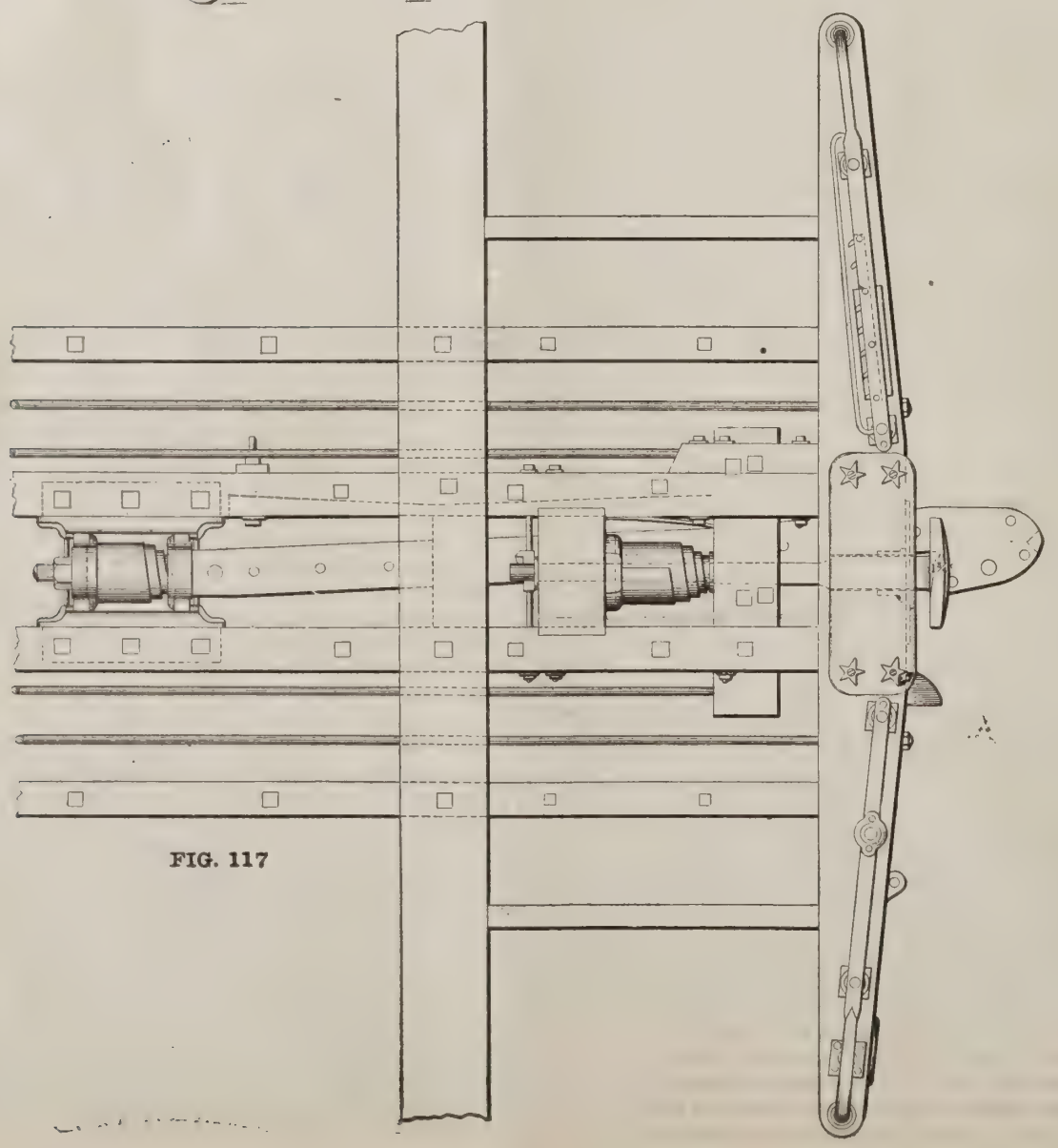


FIG. 117

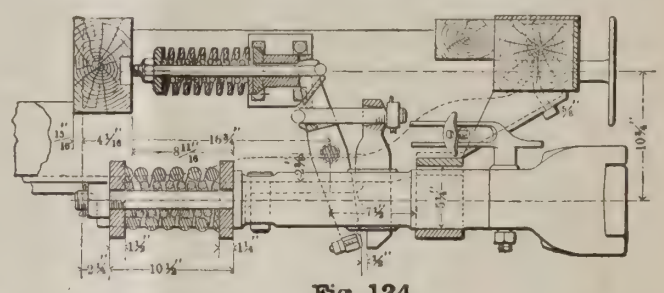


Fig. 124

The superior strength of these designs is owing to the introduction of separate spring buffers placed on a level with the line of the sills; to the additional support imparted to the platform timbers by truss rods, although these are less liable to break, because the buffing strains are transmitted in a direct line; and to the fact, especially in Miller's design, that the coupler of one car extends a sufficient distance under the platform of the adjoining car so that the mounting of one upon the other is effectually prevented, and is possible only by the failure of one of the very substantial carry irons.

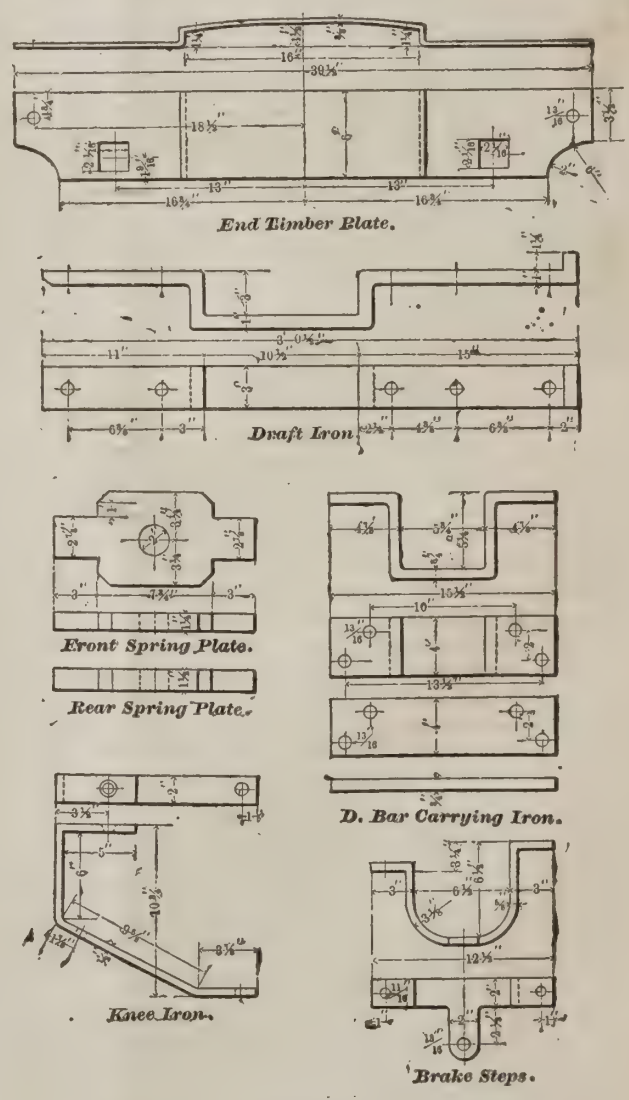


Fig. 126

The illustrations, Figs. 116 to 121, are reproduced from Miller's original working drawings. The different parts were so admirably designed and proportioned that but a very few changes have been found necessary in the long number of years this apparatus has been in use, and these are principally a change of materials rather than a change of forms and dimensions. The hooks or couplers are now mostly solid forged iron or steel castings, or when built up of pieces are much more substantial than the one shown, which consists of two $\frac{5}{8}$-inch flat bars and a skeleton filling

piece of cast iron, although they are still frequently the same as the original, with possibly a malleable instead of a cast-iron filling. The bolt connection has also in some instances been changed to a strap or yoke similar to that used for attaching freight car couplers, it being generally considered more reliable. The follower plates, which were originally of cast iron, have for the same reason been abandoned, and wrought iron plates about 1¼ inches thick been substituted. Both draw and buffer springs are here of the volute type, which is at this date but seldom met with in car construction; for the purpose in question springs of the same dimensions and resistance as used for freight car drawbars are the rule. The drawbar side or stop castings are also usually so modified that their removal for the purpose of renewing a spring or follower plate is avoided. This is accomplished by using loose wrought bars bolted to the castings in place of the lower retaining flange on them.

The side castings are substantially fastened to the drawbar timbers with six ¾-inch bolts each, three of these passing through the center sill of the car. The draw timbers are from 4 to 4½ inches thick, 12 inches wide under the platform, and reduced to 6 inches wide under the car; they extend in one piece from the platform end timber to the body bolster when this is of wood, and through and beyond it when of iron, precisely like those of freight cars. Between the front or wide portion of the pair of draw timbers there are framed to them in the manner shown two blocks, one of which is termed the truss beam, and serves as a support for the platform truss rods, which pass through the end sill and terminate at the bolster. The second block acts as a stop for the buffer spring, which does not, however, come in direct contact with it, a cast-iron plate or cup being provided both to prevent wearing the wood, and to increase the surface of contact.

The buffer itself is an iron or steel forging, and may be considered as consisting of three parts: The head, bar and stem. The stem passes through the spring and buffer spring beam, in the rear of which it is fitted with a strong cotter to retain it. The shoulder formed by the junction of the stem with the bar bears directly on the spring, if this is of the volute pattern, but if it is a spiral a plate similar to that above described must be provided. The bar is rectangular in section to prevent turning in the cast or malleable iron guide; the guide is retained in its socket by a plate attached to the face of the end timber.

A pair of 3 or 4 inch timbers, termed platform timbers, which resemble the draw timbers in shape, like these extend back to the bolster, and are bolted to the intermediate and end sills, together with the draw timbers from the foundation of the platform. The two short beams, the platform sills framed in between the end sill and end timber, may be dispensed with if the intermediate floor timbers, and consequently the platform timbers also, can be placed to meet the requirements of the platform floor.

The platform end timber, which is in its largest cross-section 8 inches wide and 7 inches deep, and otherwise shaped as shown, is kept in place by two ¾-inch rods usually running back to the transom, and in addition to this by two ⅝-inch rods located close to the platform sills, but extending through the end sill only. The end timber, which is raised above the platform timbers one inch, or the thickness of the floor so as to be flush with this, carries the end railing, uncoupling lever, brake shaft and coupler guide or stop. The railings, ordinarily of wrought iron, are supported on four wrought-iron tapering posts of 1¼ inch largest diameter, which are firmly attached to the timber by means of nuts, and are braced by large cast-iron washers or sockets. The uncoupling lever, which passes through a slot in the timber, and is pivoted to the under side of this by suitable trunnion plates, is connected with the coupler by a short chain; the upper or handle end of the lever is confined within a guide usually formed in one piece with the railing, and which is shaped with several notches for the reception of the lever when it is desired to lock the hook in the uncoupling position.

On the opposite side is placed a cast-iron stop designed to limit the lateral motion of the hook enough to prevent uncoupling. This casting is secured by a ¾-inch bolt passing both through it and the end timber, and is maintained in its vertical position laterally by a ¼ by 3-inch bent bar, which also does duty as a step for the brake shaft, and in the other direction by a brace attached to one of the draw timbers.

To prevent uncoupling the hook has an inclined face, and in addition is acted upon by a two-leaf spring placed alongside of it, and which is kept in place by the two carry irons, the second or back hanger, as it is usually termed, serving as a fulcrum; the spring is strained to any desired degree by a bolt and bracket for this purpose provided.

The main carry iron is attached to the under side of the truss beam by four ¾-inch bolts; its position is oblique and several inches from the center line, and on its proper dimensions and adjustment greatly depends the automatic action in coupling. In addition to doing duty as a support to the side spring, the back hanger serves as a safety hanger to the drawbar; it does not, however, carry the drawbar as its name would suggest, as long as all the parts are in proper repair.

The working dimensions, although not all given in the above description, may be readily obtained from the drawings, in which have been included, and for this purpose, details of the principal members.

The Janney platform and coupler are not used as extensively as the Miller, probably because, as has already been mentioned, they are of more recent date, and not that they are less perfect; in fact, they are the best, and should be preferred if for no other reason than that the Janney or Janney type of coupler is the standard of the M. C. B. Association for freight cars. As the Miller system is, however, in use on the majority of roads, and is on the whole satisfactory, a change will in all probability be effected, but slowly, the one item of expense being the greatest obstacle.

The only serious objection to the Miller hook is the trouble experienced with it in uncoupling, which is more or less difficult under all circumstances, and when the conditions are unfavorable, as on curves, is frequently impossible. This may be due to a slight variation in the alignment of two adjoining cars, but mostly to the inclined faces of the couplers on which bear the combined pressures of the buffer and draw springs. If the buffers do not project beyond the faces of the hooks, then they will not always be in contact, and a close coupling is not effected; on long trains the buffers frequently part even when the proper amount of projection has been allowed.

The Janney coupler can be operated with ease, and the action of the buffers is such that an outward movement of the drawbar produces a corresponding motion of the buffers and an increased pressure on the buffer springs. This is accomplished by a mechanism through which the buffers are connected with and controlled by the drawbar.

Referring to Figs. 122 to 126, which show the general arrangement and some of the details of the Janney platform, and particularly to the longitudinal section Fig. 124 for the apparatus under consideration, the principal member of this is a lever or *combination yoke* pivoted on a 1¼-inch bolt, which is located a few inches above the drawbar, and passes through the draft timbers, the holes in which are bushed with iron ferrules to guard against wear. The connection of the upper arm with the buffer equalizer and spring is effected through a 1¼-inch T-bolt. As the buffers are intended to move outward whether the drawbar moves in the same or a contrary direction, the latter must be able to act in the first case on the portion of the yoke above the fulcrum, or the upper arm, and in the other case on the lower arm. The upper connection is made with a T-bolt and post or horn fitted to a slot in the drawbar; the lower by simply bringing the yoke which sur

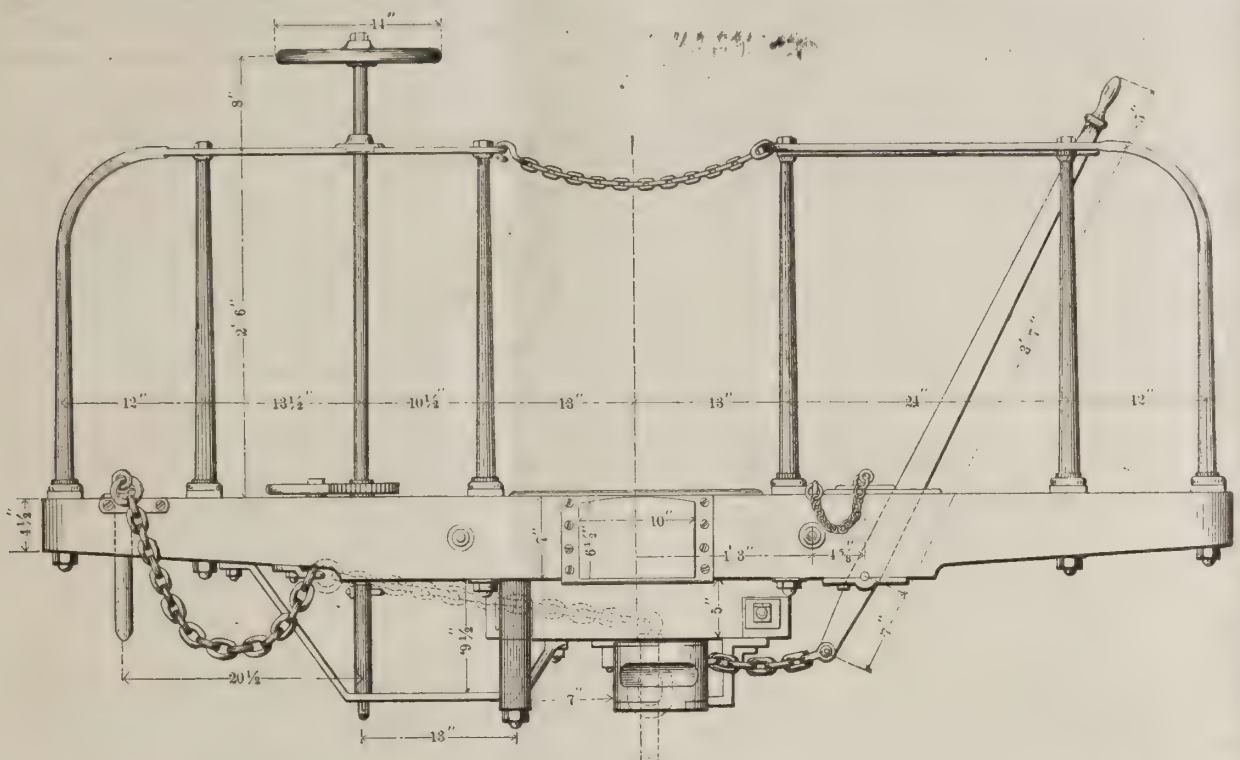


Fig. 118

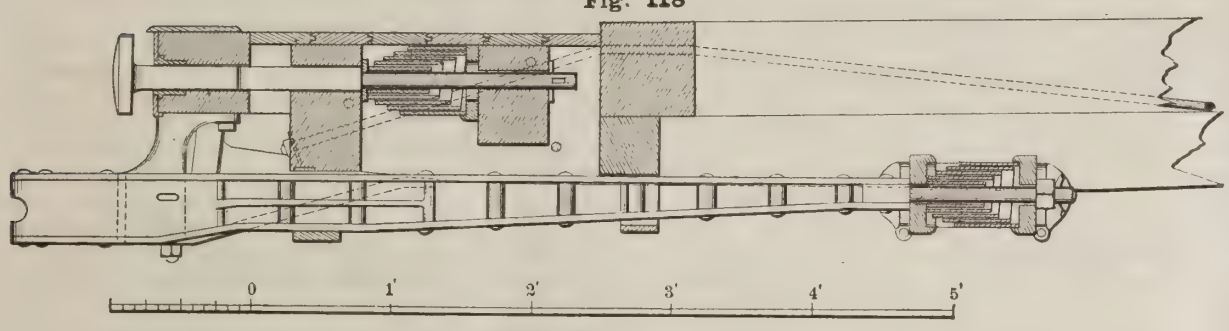


FIG. 119

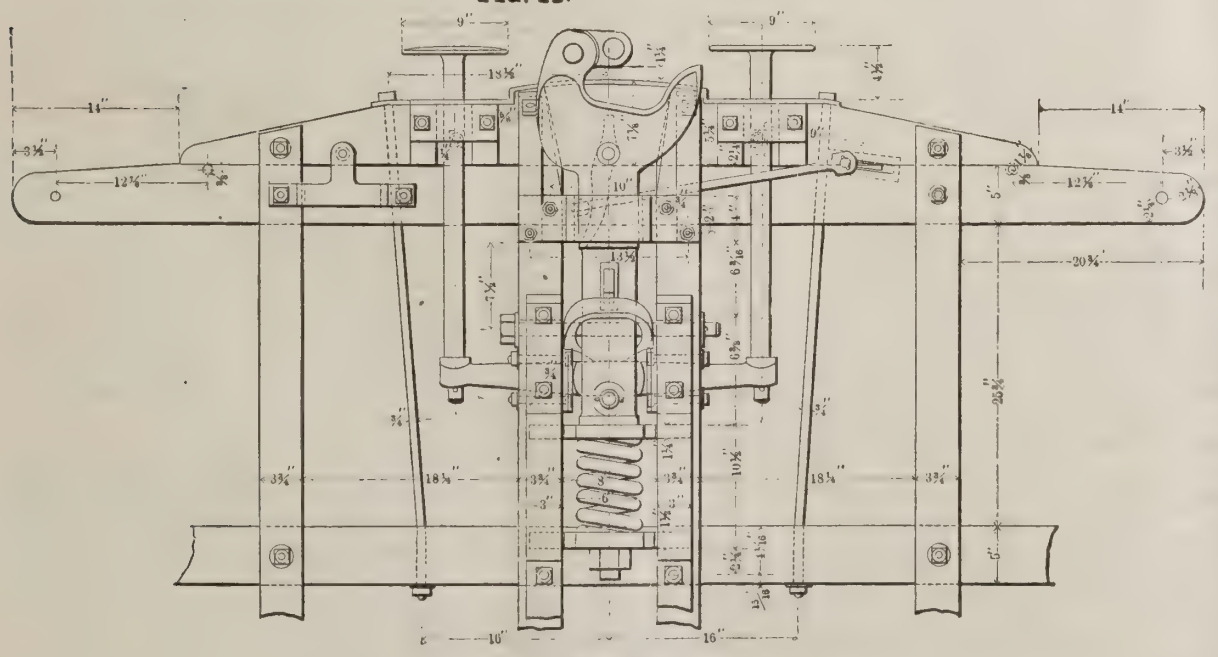


Fig. 122

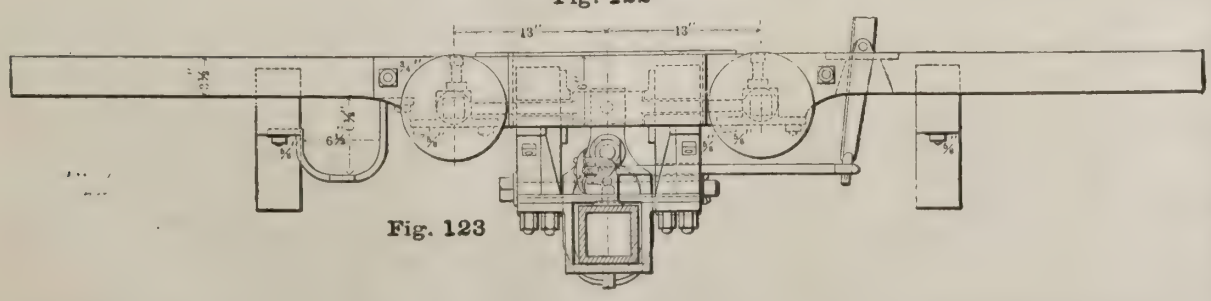


Fig. 123

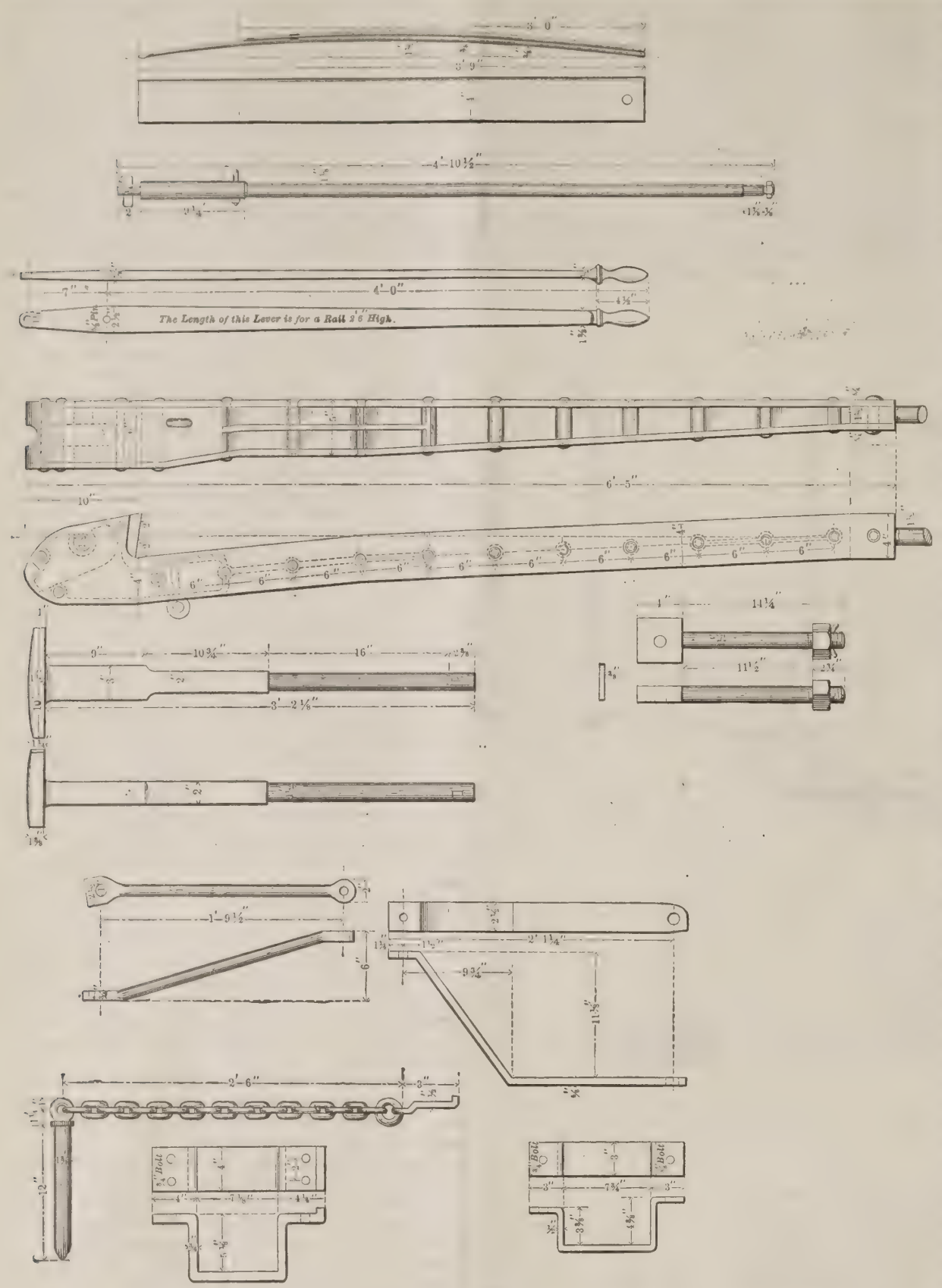


Fig. 20.

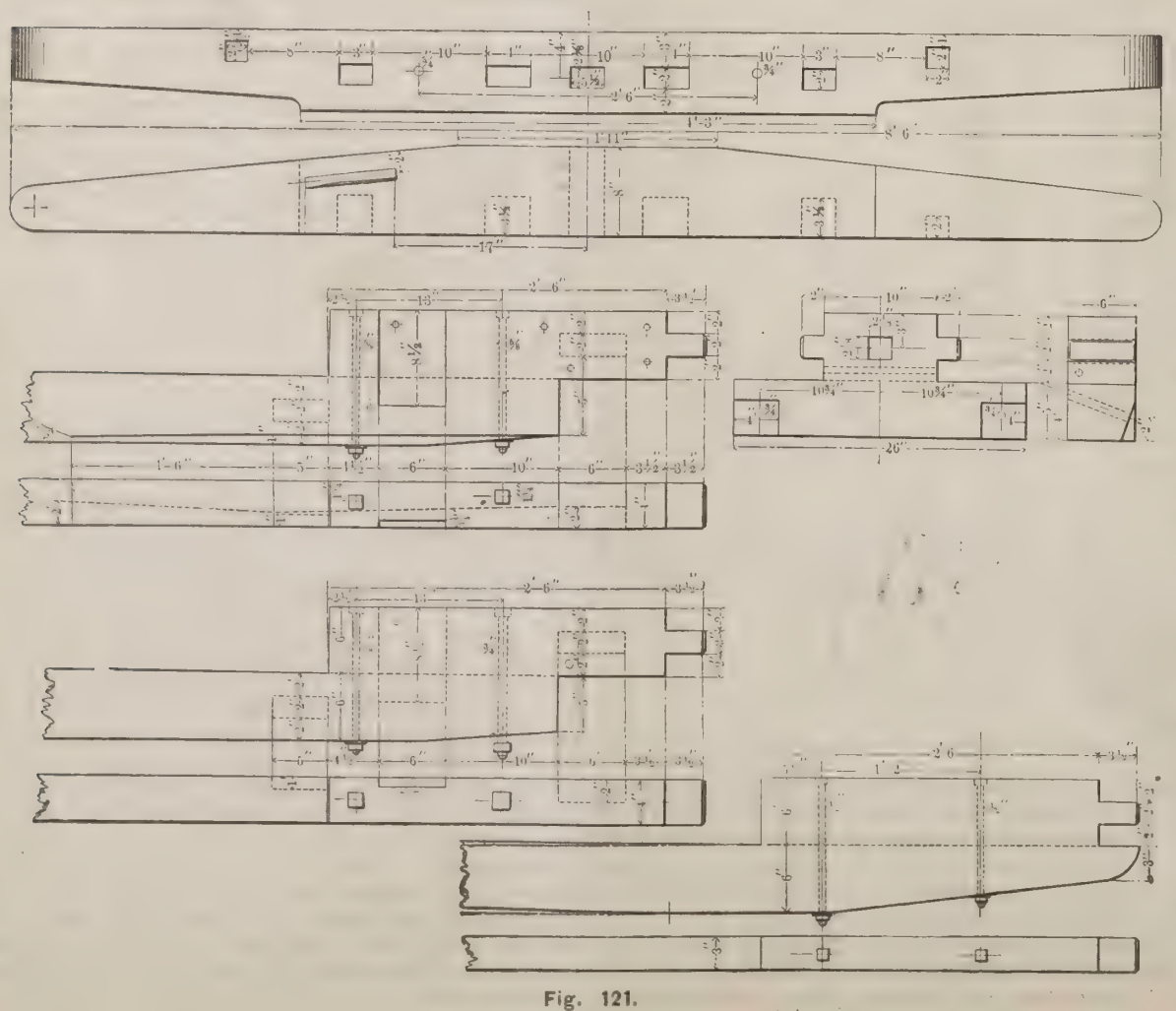


Fig. 121.

rounds the drawbar in contact with the protruding end of the post.

The buffers are two in number, but for what particular purpose is not apparent, unless the double force was introduced to avoid the then existing patents on the Miller single central buffer. They are retained by malleable iron guides let into and bolted to the end timber, and attached to the above mentioned equalizer, by the introduction of which as flexible a connection as is obtained with a single buffer is insured. The equalizer is supported by the draft or main knee timbers, which are provided with suitable mortises and guides for that purpose.

The buffers and equalizer are either malleable castings or forged iron; the latter is usually preferred, because it is more reliable, and can be produced at very nearly the same cost. The combination yoke is always a casting (malleable or steel); its form is so complex that it cannot be forged at a reasonable cost.

The construction of the platform itself is in the main not altered; the longitudinal timbers are of about the same size and form as those of the Miller, and are secured to the body of the car in a similar manner. A change is, however, made in the form and fastening of the end timbers, but not for the reason that any feature of the coupler or buffers requires this. It is composed of two separate pieces, one of which, the inner piece, is 3½ inches thick by 5 inches wide, and of the usual length; it rests on the knee timbers, which are cut down at the ends to receive it, and is secured to them by one ⅝-inch bolt through each, those passing through the main knee timbers also assisting to retain the drawbar carry iron. The outer piece is 6 inches thick for a distance of 3 feet, the remaining 1½ feet at each end being reduced to the same thickness as that of the main end timber. Its width is 6¾ inches at the center line, 5¼ inches where the buffers are attached, and tapering from those points to the ends. This timber is, like the first, fastened to the platform timbers with vertical bolts, to the draft timbers with the iron straps that cover the ends of these, and to the end sill by two ¾-inch rods.

The parts of the Janney platform that have so far not been enumerated are the railings, uncoupling lever, drawbar attachments and carry iron. There is nothing unusual about them that requires a special description; the drawings are complete enough in dimensions and details to serve as a guide for an application of the apparatus.

The interchange of passenger cars is not very extensive, and the most of it occurs between allied roads who generally use the same or similar couplings; there are, however, certain classes of cars that are frequently passing over roads where a coupling foreign to the one they are equipped with is in use. For reasons already stated, it is not safe to employ the link and pin for this purpose, especially as all automatic couplers are but illy adapted for this. Such cars are, therefore, generally fitted with platforms and special fittings so constructed that a change from one system to another can be quickly effected; this has, however, reference to the Miller and Janney platforms only, as these are practically the only systems in use in this country.

It is not thought necessary to illustrate this, what is known as the combination coupler, because no new features are introduced. The platform is essentially a Janney, with the following alterations and additions: The drawbar is in sections, and the joint is located between the combination yoke and carry iron, so that the parts which operate the buffers be not disturbed. When a change is desired the front part, or coupler proper, is removed by withdrawing the coupling bolt and a short hook coupler substituted. To give this the required lateral motion the opening in the carry iron is enlarged. The stop casting, necessary with the hook coupler, is permanently attached as is also the side spring, which is in this case of spiral form, and is located on the right hand side; the same uncoupling lever serves in both cases.

The Janney buffers and all their fixtures are as usual; the center buffer is inserted when needed, a guide on the header and a cross-head on the equalizer being provided for the purpose. A slight alteration is necessary in the application of the spring; the washer at the rear of this is replaced by a follower plate working in guides which are attached to the end sill of the car, and are so arranged that they receive the strain.

The Cowell buffer and coupler are used to a limited extent on a number of roads, and have been adopted as the standard for passenger equipment by a few. The construction of the gear is such that it couples with the Miller, and the coupler at least can be substitued for the Miller hook without making a single change in the platform and attachment; in fact the Cowell coupler is nothing more than a Miller hook which has the head arranged to work on a hinge, which feature overcomes all trouble in uncoupling. The coupler is principally of malleable iron, that is, the head and front portion of the bar are of this material; the rear portion is constructed of flat bars like the Miller, like which it is also attached to the follower plates and springs.

A radical change is, however, made in the shape and the application of the buffer; although this does not prevent it from working with the Miller. It is very much longer and so constructed that a continuous floor is maintained between the cars when coupled, a feature specially valuable for vestibuled cars. To permit so broad a buffer to adjust itself on curves, its connection with the stem must be flexible; a hinge is, therefore, introduced at this point, and either under or back of the platform end timber a pair of coiled

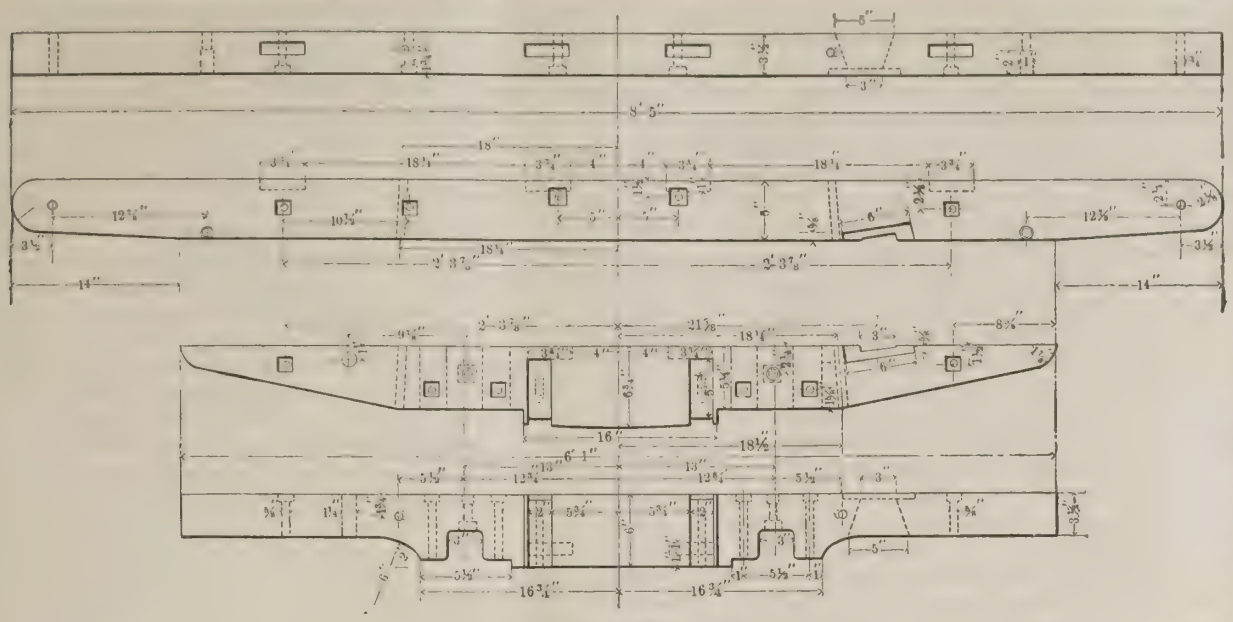
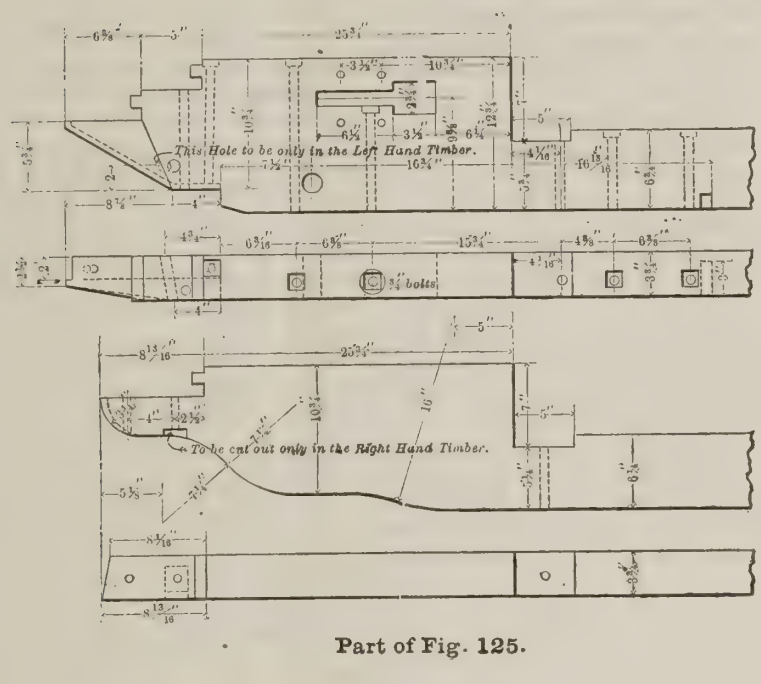


Fig. 125



Part of Fig. 125.

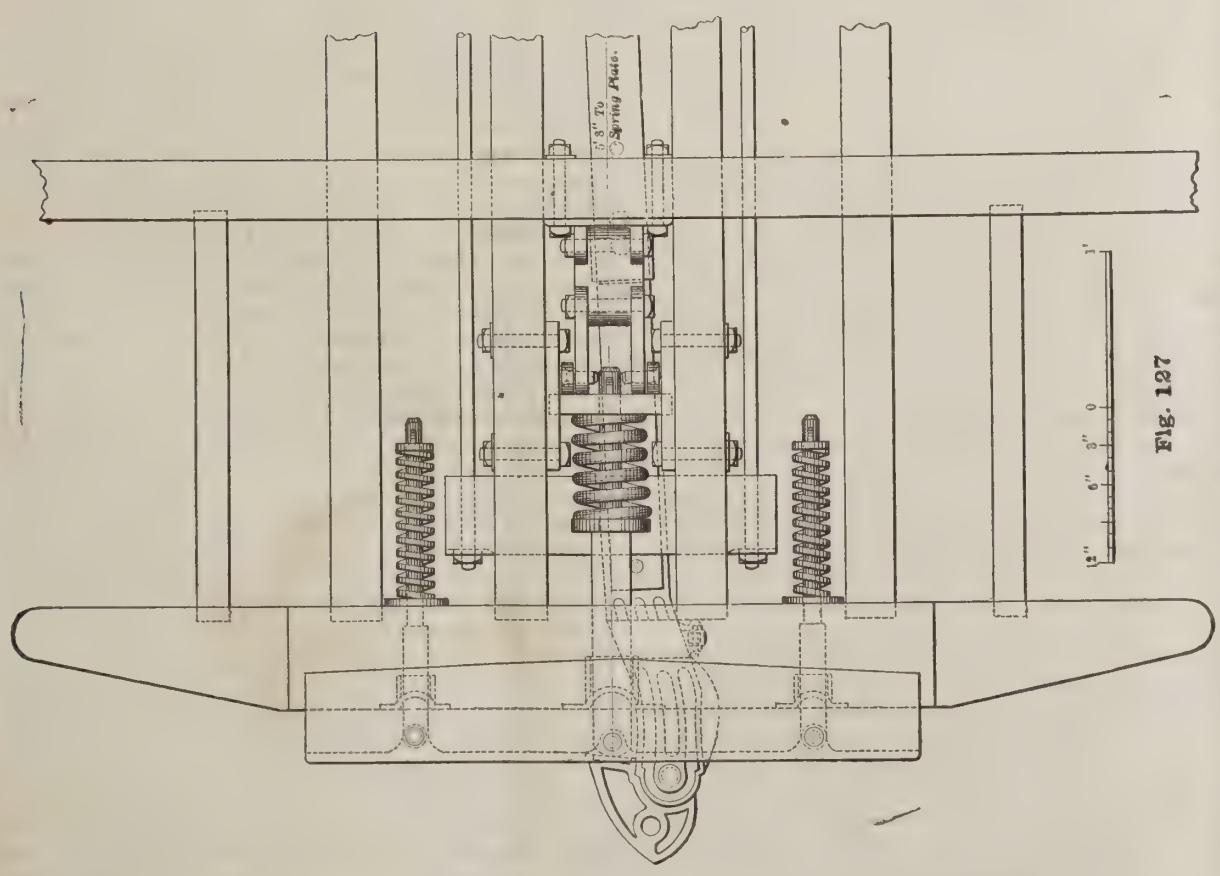


Fig. 127

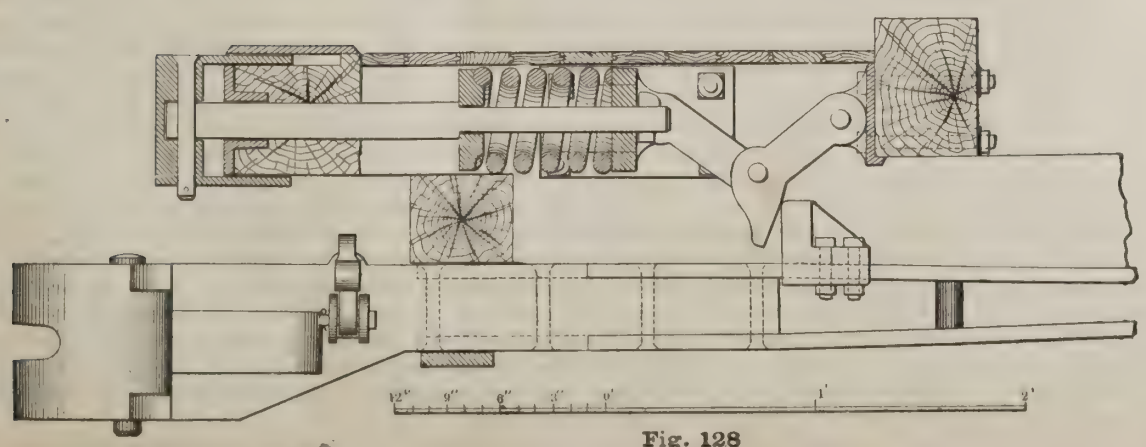


Fig. 128

springs of moderate strength, for the purpose of returning the buffer to its normal position. The fault in the action of the Miller buffer has also been corrected by introducing back of the main spring a toggle joint which comes in contact with a stop or horn secured to the drawbar; the result is practically the same as that produced by the Janney buffer.

Figs. 127 and 128, the one a plan, and the other a longitudinal section, show the parts affected only; all other parts are substantially the same as those described and illustrated in connection with the Miller platform.

There is one adjunct of platforms, one that is usually considered indispensable, that has not been mentioned; this is the so-called safety appliance almost invariably provided as a means to insure a connection between the cars in case some part of the couplers proper, or their attachments, should fail.

These safety couplings are short chains and hooks located on each side of the drawbar, about 15 inches distant from the center line, and are secured to the platform end timber. It is doubtful whether these chains, as applied, ever prevented the breaking in two of a traiu; the absence of all elasticity, together with so much slack, is almost certain to result in their fracture, or the giving way of the point of support. If it is necessary for the safety of the train to have these chains, they should be attached with cushions or springs, and to some member of the car more substantially secured than the end timber. It would seem, however, that they might be dispensed with altogether, as the automatic brakes with which all passenger trains are now equipped guard against collisions in all such cases. Another reason why safety chains should not be used is the fact that they must be hooked and unhooked by hand, which necessitates the going between or under cars, to avoid which is the principal and only duty of automatic couplers.

In connection with this subject it is perhaps timely to mention that the location of the brake and steam hose connections is for the same reason objectionable. Accidents do not occur very frequently in coupling passenger cars, and that is perhaps the reason why this subject has not attracted much notice; but when all or the majority of our freight cars shall have been equipped with self-couplers and continuous brakes, as they will be in the near future, this may become a serious matter, and one that will be expensive to remedy.

Profits of Car Mileage.

The cost of the investment in cars, says the Interstate Commissioners' Report, and the amount of mileage allowed for their use, show that the investment is very profitable. Refrigerator cars cost from $900 to $1,000; private cattle cars cost about $650; oil tank cars about $610; cars used for the transportation of live hogs about $500; ordinary freight cars from $450 to $500. Repairs to the cars are made by the railroad company in whose use they are when repairs are required. The life of a box car averages 15 years, and of a refrigerator car eight years. At a car mileage rate of one cent a mile the profit on the investment in many of these cars is very large, reaching, according to information acquired by the Commission, 25 per cent., 50 per cent., and even more, annually. Sometimes a car will pay for itself in two or three years. Owners of several hundreds of such cars, therefore, receive a very large amount of money from the railroads over which they are hauled, and it is easy to see how it is possible, out of the large returns from these cars, for owners to pay rebates to shippers, if so disposed. The evidence taken in the case did not prove the payment of rebates to shippers by owners of any of these cars, but it was quite clear that some of the officers of railroad companies who were examined had impressions that such might be the fact. It is also evident that the payment of either one cent or three-fourths of a cent a mile to a large shipper owning and controlling his own cars and furnishing business therefor constitutes a very profitable incident to his legitimate business, and is, at least, a material advantage to the man owning cars over the man who owns none.

A forcible illustration of the results of car mileage to owners of private refrigerators cars appeared by a statement put in evidence from the books of a railroad company, showing the mileage made, and earnings of some of such cars, for nine months, from Aug. 1, 1888, to May 1, 1889. During that period the mileage for which compensation was allowed, made by the cars of three shippers, from Chicago to an eastern point, and over a single line of road, was 7,428,406, and the earnings of the cars $72,945.97, being about the cost of 81 cars. The mileage allowed during most of this period was one cent a mile, and three-fourths of a cent a mile for a part of the period. Refrigerator cars run on fast time, and make four times the mileage of ordinary freight cars.

There is talk of the New York Central and Michigan Central railroads running a train to Chicago in 23 hours. The operating officers belonging to these railroads are confident that a train could be run on still shorter time, but they are not enthusiastic about making the run on less than the present schedule time.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Eighth Paper.

Distribution of Work in Three-Cylinder Compound Locomotives.—It was shown in the theoretical discussion of the distribution of work between the cylinders of two-cylinder receiver compound locomotives, that with the same points of cut-off in both cylinders and with the ratios of cylinder volumes which are practicable in locomotives, considerably more than one-half of the total work will be done by the low-pressure cylinder. It was also demonstrated that the work can be to a great extent equalized by making the cut-off in the high-pressure earlier than that in the low-pressure cylinder.

The same process of reasoning can be applied to the three-cylinder type of compound engines, inasmuch as we may

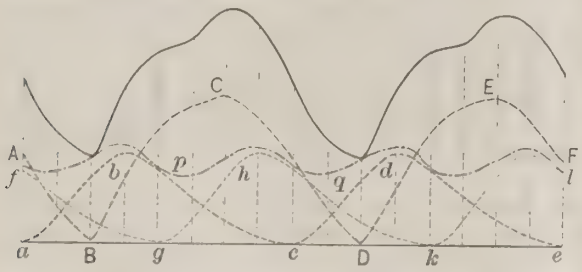


Fig. 37

regard this form as a development of the two-cylinder type, produced by substituting either two smaller high-pressure cylinders for the original high-pressure cylinder, or else two smaller low-pressure cylinders for the original single low-pressure cylinder. It is, therefore, to be expected that, with the same points of cut-off in all three cylinders, considerably more than one-half of the total work will be done in the single low-pressure cylinder of the Webb type of compound locomotive, and in the two low-pressure cylinders of the other form of three-cylinder compound locomotive which, for the sake of brevity, may be called the French type. We may even go a step further and say that, with the ratios of cylinder volumes which are practicable, the total work cannot be so divided that much less than one-half of it will be done in the low-pressure cylinders. This statement is borne out by the published indicator cards of the Webb locomotive and leads to some interesting conclusions.

These indicator cards show that the proportion of the total work which is done in the low-pressure cylinder is from 50 to 65 per cent. at various speeds, with the low-pressure valve in full gear. As making the low-pressure cut-off earlier would increase the proportion of work done in that cylinder, it follows directly that the low-pressure cylinder's share of the total work is *at least* 50 per cent. As the Webb locomotive has no coupling rods between the high and low-pressure axles, and as the weight on each pair of drivers is very nearly the same, it is evident that this division of work is the best under the circumstances. This point and others can be well illustrated by a diagram of crank efforts. Such a diagram is shown by Fig. 37, which was constructed from indicator cards of a Webb locomotive which were published in *Engineering*, May 24, 1889. Steam was cut off at about ten inches in the high-pressure cylinders, and the low-pressure admission was at "full gear." The speed is not recorded, but from the form of the high-pressure admission line is evidently not great. The mean pressure is approximately 81 pounds in the high-pressure cylinders, and about 34 pounds in the low-pressure cylinder, which is equivalent to $34 \times 2.3 = 78.2$ pounds in the two high-pressure cylinders, the work done in the low-pressure cylinder thus being nearly one-half of the total.

Referring to Fig. 37, *a b c d e* and *f g h k l* show the variations in the turning moments, or the tangential efforts on the cranks, of the two high-pressure pistons, the cranks being at right angles, and the irregularity caused by the connecting rods being neglected. The combined efforts on these two cranks is shown by the curve *f p q l*. The

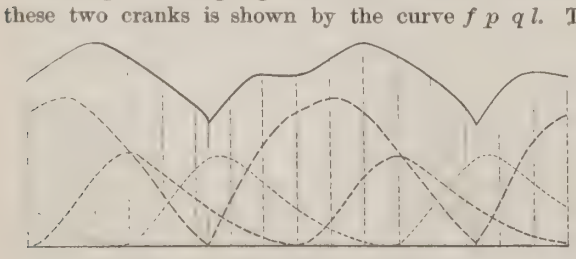


Fig. 38

variations in the turning moments on the low-pressure crank are shown by a curve such as *B C D*, and if we assume that the low-pressure crank makes angles of 135 degrees with the high-pressure cranks, this curve and that for the other stroke *D E F A B* will be located as shown in the figure. Combining the high and low pressure diagrams gives the full line curve in the figure which represents the variations in the pulling power of the locomotive during one revolution, as shown by the indicator cards, and therefore without taking the inertia of moving parts into consideration. A comparison of this full line curve with the curve of the combined high-pressure cylinders *f p q l* shows that the angles between the low-pressure and the two high-pressure cranks are not of great importance. If the low-pressure crank were moved back about 25 degrees, so that the maximum moment for the low-pressure crank at *C* would coincide with the minimum for the combined high-pressure cranks at *p*, the combined diagram for all three cranks would be somewhat more uniform, but the difference would not be great. A diagram of crank efforts on the assumption of uniform steam pressures throughout the stroke in each cylinder shows similar peculiarities.

It would seem to be evident from this partial investigation that there would be very little advantage in connecting the high and low-pressure axles of this type of locomotive by coupling rods, excepting possibly for starting, and that, if the suppression of coupling rods is an object of importance, Mr. Webb's design meets the requirement as well as possible with three cylinders. It has been suggested that this type of locomotive might be improved by placing the cranks at angles of 120 degrees and coupling the driving wheels. The effect of this, with the steam distribution and division of work used in the construction of Fig. 37, is shown by Fig. 38, in which the full-line curve shows the variations in the combined rotative efforts on the three cranks. It will be seen that the minimum turning moment is greater than that in Fig. 37 and the maximum is less, so that there is a more uniform effort throughout the revolution. The performance of the locomotive at slow speeds would therefore be improved by this arrangement, but as the speed is increased the inertia of the moving parts tends to diminish this apparent advantage, so that it is doubtful if there would then be any practical gain by the introduction of coupling-rods.

Turning now to the French type of three-cylinder compound locomotives, it will be found that an application of the same method of reasoning leads to very different results. As has been pointed out, the steam distribution is different in the two low-pressure cylinders, but it is nevertheless to be expected that more than one-half of the total work will be done in the low-pressure cylinders with the same points of cut-off in all three cylinders. Also by adjusting the points of cut-off, the proportion of the total work done in the high-pressure cylinder can be decreased. It is therefore possible with this type of engine to divide the total work equally among the three cylinders.

In this locomotive the two low-pressure cranks are placed at right angles, and the high-pressure crank is placed at 135 degrees with the others. A diagram of crank efforts with this crank arrangement and on the basis of an equal division of work, and steam admission during about seven-

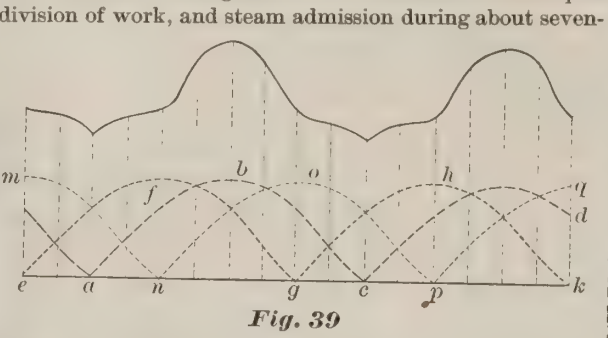


Fig. 39

eighths of the stroke, is shown by Fig. 39. In this figure, *a b c d* is the high-pressure diagram, and *e f g h k* and *m n o p q* are the low-pressure diagrams. The combined diagram for all three cranks is shown by the full-line curve. If the cranks were placed at angles of 120 degrees, the combined diagram would have the form shown by the full-line curve in Fig. 40, from which it is clear that this disposition of cranks would give a very constant turning moment.

It follows from these diagrams of crank efforts, in connection with the previous statements regarding the division of the total work, that coupling rods are as much a necessity for the French arrangement of cylinders as they are a useless complication in the Webb system. The work cannot be so divided that as much as one-half of the total will be done in the single high-pressure cylinder of the former, while nearly one-half is necessarily done in the single low-pressure cylinder of the latter.

Starting Power of Three-Cylinder Compound Locomotives.—It has been already stated that the starting conditions for the French type of three-cylinder compound locomotive are the same as for an ordinary locomotive, inasmuch as the low-pressure cranks are at right angles, and the form of valve gear adopted for the high-pressure cylinder makes it possible to let steam blow through that cylinder without doing work. It is, therefore, possible to admit steam at nearly boiler pressure to the low-pressure cylinders, and the starting power of the locomotive would then be about the same as that of an ordinary locomotive having cylinders of the same size as the low-pressure cylinders, 19.69×27.56 inches, and 199 pounds boiler pressure. But as it is not probable that a valve gear of that form would be adopted in American practice, it may not be out of place to consider the effect of some other possible arrangement.

There would not apparently be any practical difficulty in the application of starting gear of the Lindner or the von Borries-Worsdell type to three-cylinder locomotives of this form. With the Lindner starting gear, steam at reduced pressure is admitted to the receiver, and therefore acts as forward pressure on the low-pressure pistons and as back pressure on the high-pressure piston. With an arrangement of cranks such as that of the French locomotive, this amounts to having an ordinary locomotive with 19.69×27.56 inch cylinders and with a pressure in the cylinders equal to about one-half the boiler pressure, aided by a single cylinder, 17 inches in diameter, with about the same effective pressure. The position of the cranks, for which the combined turning moment will apparently have its minimum value, is that at which one low-pressure piston has passed just beyond the point of latest cut-off. The high-pressure crank has then moved through but a small angle from a dead point and the other low-pressure crank is not far from the half-stroke position. An approximate calculation, which is sufficient for our present purpose, shows that the combined effort on the crank pins is then equal to that of an ordinary locomotive having 19×24 cylinders, at its most disadvantageous position for starting, with 174 pounds effective pressure in the cylinders. As the weights and diameter of driving wheels of the French locomotive do not differ much from those of well-designed six-coupled American locomotives having 19×24 cylin-

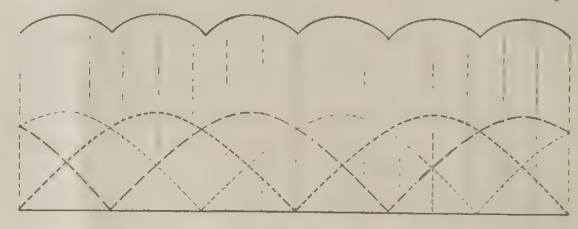


Fig. 40

ders, it is evident that the compound locomotive with the simple Lindner starting gear would be fully equal in starting power to the ordinary locomotive. It would, therefore, seem to be unnecessary to introduce intercepting valves, or other, and more complicated, starting arrangements. That the power of the compound locomotive at other crank positions is superior to that of the other will be made clear by an inspection of diagrams of crank positions, such as Fig. 29.

It has been shown that if the cranks of a French type of compound locomotive were placed at angles of 120 degrees the combined turning moment would be considerably improved, and it appears from an examination of a diagram, such as Fig. 29, that, with a starting gear of the Lindner or von Borries form, the starting power will be increased. As before, the most disadvantageous position for starting will be that at which one of the pistons has passed just beyond the latest cut-off position. The cranks of the other two pistons will then be at approximately 25 degrees and 85 degrees with the center line, and the combined crank effort will be equal to about 1.4 times the maximum of one cylinder as against about 1.13 times that of one cylinder for the most disadvantageous position with the arrangement of cranks actually used on this locomotive. The latter is, of course, the best disposition of cranks with the system of steam distribution which was adopted. It may be useful to note that on the assumption of a uniform steam pressure throughout the stroke on all three pistons inversely proportional to their areas, the combined effort on the crank pins varies from 1.4 to 1.73 times the maximum for a single cylinder for the 90 and 135 degree arrangement, and from 1.73 to 2 times the maximum for one cylinder for the 120 degree arrangement.

In the Webb compound locomotive, as now built, no provision is made for admitting steam from the boiler directly to the low-pressure cylinder. The work of starting therefore devolves at first upon the high-pressure cylinders, which is equivalent to saying that the locomotive is primarily equivalent to a simple locomotive having 14×24 inch cylinders and 175 pounds boiler pressure. It has been shown that the turning power on the cranks of the ordinary locomotive in starting may vary from about .75 to 1.4 times the maximum for one cylinder, the lower limit corresponding to the position at which steam cannot be admitted to one cylinder. The tractive power of the Webb locomotive, of which the principal dimensions have been given, would then vary at starting from about .19 to .34 of the weight on the high-pressure driving wheels. It is perfectly possible that the lower value may be encountered in practice, but it is not probable, the case being about the same as that of an ordinary locomotive. he probability is that the high-pressure cranks will be in such positions that the tractive power at starting, with full boiler pressure on the high-pressure pistons, will be from .25 to .34 of the weight on the high-pressure driving wheels. If this is sufficient to slip the driving wheels, steam will then be admitted to the receiver and so to the low-pressure cylinder until the pressure in the receiver rises to such a point that the effective pressure on the high-pressure pistons is not enough to slip the wheels. The locomotive will then be in condition to start as a compound, all three cylinders being available. Another factor has now to be taken into consideration, which is the position of the low-pressure crank. Owing to the absence of coupling rods, this may be anywhere between a dead point, in which position it is of course useless, and a half center where it can exert a pressure equal or superior to the combined high-pressure pistons. It is evident that there is a wide range of possibilities in the starting power of the Webb locomotive, using the term starting power as we have heretofore in discussing two-cylinder locomotives. The exact starting conditions will be partly accidental, and partly dependent upon the skill of the engineer in stopping the locomotive in a good position for starting.

The starting power of locomotives having the Webb ar-

*Copyright, 1889, by Arthur T. Woods.

rangement of cylinders, but with the cranks at angles of 120 degrees and coupled driving wheels, will be similar to that of the French type having a like disposition of cranks. Some form of starting valve would then be necessary or else the locomotive would be reduced, for all positions at starting, to a simple locomotive having two small cylinders and cranks 120 degrees apart. Without entering into a detailed investigation, which the practical value of this form of construction does not seem to warrant, it appears that two cylinders would always be available in starting, and that if one of these was the low-pressure cylinder, the locomotive would have ample power, while if the low-pressure was unavailable, there would be an evident deficiency.

THREE-CYLINDER LOCOMOTIVES IN PRACTICE.—The published records of the comparative performance of ordinary and three-cylinder compound locomotives are not as complete as those for locomotives of the two-cylinder type. It is to be remembered, however, that any saving which has been effected by their use is not due to their having three cylinders, but is the result of the application of the compound principle, which necessitates a more economical use of steam in ordinary running. The following is a summarized statement of the work of compound locomotives on the London & Northwestern Railway, as given out by Mr. Webb in June, 1889. Seventy-five compounds had run 11,644,222 miles since the introduction of the system in 1882, with an average fuel consumption of 32.9 pounds per mile. One express locomotive had run 154,342 miles in about 41½ months on an average coal consumption of 36.5 pounds per mile, including that burned while standing in steam or issued for all purposes. The average of forty of the same class was 36.8 pounds per mile. On the Metropolitan District Railway a converted locomotive had run 178,337 miles on an average coal consumption of 23.2 pounds, against 32.4 pounds average for six months for an ordinary locomotive doing the same work.

A report of the results obtained with three Webb compound and three ordinary locomotives in India, doing the same class of work, for the month of Janury, 1886, shows an average coal consumption of 37.57 pounds per mile for the compounds, against 47.14 pounds per mile for the ordinary locomotives. The average mileage for the month was 2,448 and 1,700 miles respectively.

No reports of fuel tests of the French three-cylinder locomotive have as yet been made public. It is reported as having hauled very heavy trains (*Engineering*, Dec. 6, 1889) up grades of 1 in 200 at speeds of from 12½ to 30 miles per hour, but the records do not appear to be valuable for comparison with American practice. It was found that the exhaust nozzle (4.21 inches in diameter) was too small for satisfactory work at the higher speed.

COMPARATIVE SUMMARY.—The reasons which would lead to the selection of the three-cylinder type of compound locomotive in preference to the two-cylinder form have been already mentioned. The better distribution of weights is obvious; it has been demonstrated that the combined turning moment is better, and the greater possibilities in the direction of utilizing high boiler pressures economically are apparent, as we find a cylinder ratio of 2.3 in the Webb locomotive and 2.68 in the French, which would be impracticable ratios for heavy two-cylinder locomotives. To this may be added that with the French arrangement of cylinders it is possible to construct a very powerful and an economical locomotive, for which the low-pressure cylinders will be no larger than those now in common use.

To offset these advantages we will have a cranked axle of considerable increase in the number of parts and a consequent increase in first cost and expense of maintenance. It is not the intention of the writer to discuss the merits and demerits of cranked axles nor to advocate their use. But in view of the fact that there are hundreds of them in use on locomotives in Great Britain and in Europe, the necessity of using them should not stand in the way of a trial of three cylinder locomotives if other considerations make such a trial advisable.

In this connection it should be noted that the Webb compound locomotive, probably from the fact that it has been the most widely illustrated of any type of compound, has apparently come to be regarded by many as the standard by which all compound locomotives are to be measured. It has been unreasonably attacked and unjustifiably vaunted. The weak features in its design, from an American point of view, have been charged to the compound system in general, and its successes credited to the personal superintendence or "nursing" of the inventor. That the latter is a factor which is at least worth considering in estimating the value of the reported results, should be evident to all who are familiar with the management of steam machinery. It will not probably be questioned that a superintendent of motive power can, by paying special personal attention to some one item of expenditure, secure a notable saving therein, although it is not unlikely that this concentration of supervision may make more important losses possible. And it has not shown that a change in engineers may result in a greater saving of fuel than can ordinarily be expected to follow the introduction of compound locomotives. But there is reason to believe that with the *same handling* and on the *same work* a properly proportioned compound locomotive, regardless of the "system" to which it belongs, will be much more economical in the consumption of fuel than the ordinary locomotive. Whether it has two, three or four cylinders is a secondary matter. Its value as a fuel-saver compared with other means of economizing lies largely in the fact that its success depends less upon the care and attention of the engineer than does that of any device wh ch can be added to the ordinary locomotive. Failures due to errors in design or to unsuitability for the service demanded do not form a sound basis for arguments against the practicability of applying the principles of compound working to locomotives.

Speed and Work of Emery Wheels.

The first and most striking characteristic of the solid emery wheel is its enormous speed. By common consent the speed of about a mile a minute for a point upon the circumference of the wheel has been adopted. The recent increase from one mile to nearly two miles is accompanied by an increased cut, but the result is extravagant in cost, as the wear of wheel increases out of all proportion to that of the metal. Few wheels can be safely run at such a speed.

Running at the standard speed the emery wheel is equivalent to a file one mile in length passing over the metal in one minute. The hand-used tool of ordinary work at the vise bench is equivalent to a file only sixty feet in length, passing over the work in one minute. To make this comparison strictly true, the metal and the wheel must be in continuous contact for the minute. This necessary condition, apparently of general occurrence, is really seldom found and is most difficult to secure, even in lathe-turned emery wheels. It is by no means an easy task to center them perfectly upon the grinding machine, and many workmen do not center them at all. The hole apparently fits the spindle, and they trust to that. The wheel is started, the iron melts away visibly, a comet-tail of sparks flashes across the shop. The man who sees a continuous stream of sparks fly from the emery wheel deludes himself with the idea that he has a tool which is continuously at work. Such a man is surprised when an expert stops the machine, and shows him that his wheel is hot and glazed for perhaps one fourth of its circumference, but cold and apparently untouched for three-fourths—that he has in fact utilized but twenty-five per cent. of the machine's possibilities. What are the causes of this? Possibly the wheel was not round to start with; possibly it was not properly centered. But there are some causes not so evident and still a matter of doubt. Possibly the wheel material was not homogeneous and expands unequally under frictional heat. Possibly, owing to the lack of homogeneity, the metal adhered to and glazes one part rather than another. Possibly, owing to the light weight of the machine and the unsteadiness of floors, an irregularly regular vibration is set up, and the wheel and work part rhythmically. Undoubtedly the high spot formed by adhering metal shoves back the piece being ground, and a large wheel surface revolves unused before work and wheel are again in contact.

The remedy is to use those makes of wheel which glaze the least, for glazing, by making high spots on the wheel, prevents all possibility of continuous contact and steady work. The solid emery wheel is a rotary file, which runs a mile in a minute, and whose cutting points never grow dull. This is said only of the perfect wheel, though glazing is one in which the points may be dulled. In experimenting with many makes of wheels, a curious difference is seen in their tendency to glaze. In some the metal adheres to all parts of the surface, and finally becomes a continuous bronzed ring. In others the metal gathers in patches. Certain makes, however, may be considered practically free from these faults under all general conditions, a slight shininess of surface being the only visible indication, while deterioration of cut is manifested only under very light pressure.—*J. D. Paret, in Franklin Institute Journal.*

Please Shut the Door.

"If I were in charge of this road that train crew would hear from me," said a well-known railroad superintendent some time ago, as a freight train went bowling past.

"Why, what is the matter?" asked a bystander.

"Look at those doors. There are sixteen cars on the train, and on eight of them the doors are wide open. That means a harder pull for the locomotive, which means more power, which means more coal burned per car mile, which means higher operating expenses, which means a smaller dividend, which may mean an order from headquarters to cut wages, and so a strike. It's the same old yarn of the horseshoe nail over again."

"Do you manage to stop these little leaks?"

"Some of them; but I had a siege of it at first. It seemed almost impossible; in fact, it was impossible to drill it into the heads of the men that it costs more money to haul a car with open doors than when they are shut. The only way I succeeded was in giving the conductor a personal interview whenever a train was seen running with open doors. I would explain the matter and insist on greater care in the future. Then, if he persisted in his carelessness, his head had to come off. However, after a few heads had dropped into the basket the men became careful, because 'there would be a row if the old man caught them,' and now we have no difficulty."

This is undoubtedly one of the many minor leakages that so many superintendents and trainmen utterly disregard, but which may in the long run, or on a long run, amount to a tidy sum. When the train is moving slowly there is comparatively little resistance on the part of the air, but, as the resistance increases about as the square of the velocity, it is evident that the backward pull may be very considerable on a train moving at twenty-five miles per hour.

There is, of course, a certain amount of air resistance, due to the exposed surfaces of the ends and sides of the cars. But this is practically doubled on each car by an open door. The ordinary wind gauge that is made of the cup-shaped vanes whereby the rotation of the apparatus is maintained by the difference in the pressure exerted on the concave and convex surfaces of the vane, shows the influence that the open door of a freight car may have on the resistance of the train, for it practically converts the car into a huge cup moving with its concave surface toward the wind instead of a smooth, even surface cutting the air at an angle.

The question naturally arises as to how much this resistance may be. It is estimated that a 30-foot car body presents practically about 200 feet to the wind on each side.

Suppose this car to be running over the rails at a speed of twenty-five miles per hour and against a wind coming in from ahead at an angle af 45 degrees, blowing at a rate of seven miles per hour, which is a pleasant breeze.

The air resistance to this car, according to Nystrom's formula, would be about 300 pounds. As there are no reliable and exact data in regard to the increased resistance caused by the opening of the door, it can merely be safely assumed on general principles to be about 75 per cent additional. This gives 225 pounds per car that is absolutely unnecessary.

If it is objected that 25 miles per hour is too high a speed, and that 15 would be nearer the average, it is a simple calculation to ascertain that the additional resistance would be about 81 pounds.

At 15 miles per hour the speed per minute is 1,320 feet, giving 106,920 foot pounds of resistance, or an additional demand upon the locomotive for 3.2 horse-power for every car door that has been left open.

Taking the train that called forth the superintendent's speech, as given at the opening of this article, where there were eight open doors, we have an additional 25.6 horse-power called for. Putting the coal consumption at seven pounds per horse-power per hour, we have 179.2 pounds wasted for every 15 miles; or, in a run of 200 miles, a wastage of 2,390 pounds, or in round figures, a gross ton. This, at $4 per ton, would pay two-thirds of the engineer's wages at three cents per mile.

It is to be hoped that the open doors do not average eight per train; still there is undoubtedly a great deal of carelessness in this regard. In fact, upon a certain trunk line that has never been noted for the big dividends that it pays, twenty open doors were recently noticed on a train of twenty-eight cars.

While the actual loss may vary greatly from that given above, according to the direction and velocity of the wind, it may be taken as an average statement, and points the moral of "Please shut this door, and keep it shut."

It is said that the coming car for electrical surface roads will have motors differentially connected. It will not only excel in ease of riding and comfort, but will double the present life of wheels, with great economy in track, truck, and motor repairs, as well as in power, lubricants, etc.; this, and more, at schedule speeds of 10 to 20 miles per hour, and without sacrifice of safety.

This is what those interested in electrical propulsion of cars say is a necessary reform, and that it is coming round rapidly. Experience on ordinary railroads makes it very plain that so long as electrical engineers keep putting attachments on the axle of motors with no springs to soften the jars of service, so long will the call for repairs be excessive. The first aim should be to get all working apparatus carried by something having springs under it.

A new kind of car oil lamp has been introduced on the Delaware, Lackawanna & Western passenger trains. The lamp is not materially different from others used for lighting except that a reservoir is provided which holds sufficient oil to burn about a week. The Delaware, Lackawanna & Western still retain the most fragile kind of cast iron stove for heating the cars of its badly crowded suburban trains. The trains are run at very short intervals over a road entirely unprotected with modern safeguards for heavy traffic. With the big reservoir of oil now added to the cars to feed an accidental fire it looks as if the officers of the company had made the most careful preparations for working up a holocaust of passengers.

The car stove is very persistent in giving striking notice of its presence in railroad cars. Last month a train on the Northern Pacific was wrecked through the failure of a culvert. The wreck took fire and all the cars, except the sleepers, were burned up. One man who was caught by the broken timbers was burned to death.

Communications.

Steam Reverse Gear for Locomotives.

Editor National Car and Locomotive Builder:

A few days ago, while on a visit to one of our large seaport towns, I had the pleasure of going through the engine room of a large ocean steamer, and I was very much interested in the aids which were provided to enable the engineers to handle the various parts of the great engines. Since coming home it has struck me that the mechanism employed in marine work for saving labor and for providing a prompt means of handling the engines might be applied with advantage to locomotives. For years there has been a steady increase in the weight of locomotives, and the link motion and valves to be operated are ponderously heavy, yet the man handling the engine receives no more mechanical aid to do his work than he had when the engine was not one-half of its present weight. Air and steam have been applied to perform so much work about trains that was formerly done by human labor that it appears strange to me why some of the ingenuity of inventors is not directed to producing apparatus that would reverse and hook back the locomotive valve motion. Some months ago you commented upon a patented device which was to place the engine behind the train, and put in the hands of a man riding in front the means of handling the locomotive by electrical connections. The scheme was absurd in itself, but did it not have some merits which could be utilized for a reversing gear? It appears to me that the cause of humanity and fair play demands that power should be in some way applied to relieve engineers from the dreadful toil they are subjected to in reversing the heavy locomotives now in fashion.

Humanity.

Ash-Pans and Dampers.

Editor National Car and Locomotive Builder:

I was glad to see Mr. J. J. Clair's letter on "Ash-Pans and Dampers" in this month's issue of Car Builder, and I fully agree with all that he says.

The ash-pan should be as nearly air tight as possible, and the dampers should close tight.

I think that the flanging-over of the edges of dampers to depth of about 2½ in. would be an improvement over the usual practice. The rod for operating damper should be attached to lower end of a short lever projecting through foot plate, and fulcrumed at any convenient part of its length. This lever should be provided with a latch and dentate sector, so that the opening of the damper could be better regulated than with the arrangements generally found upon locomotives in this country.

The above device is very generally used in England.

If the dampers were used as much as possible to prevent engine from blowing off while running, instead of opening furnace door until gauge has gone back five pounds, as is common practice in some quarters, there would be less trouble with flues and stay bolts leaking.

Edw. L. Coster.

Aiken, S. C.

How an Unbalanced Revolving Disk Steadies Itself.

Editor National Car and Locomotive Builder:

In behalf of a correspondent you invite explanation of the behavior of an unbalanced revolving disk at low and high rate of speed.

The cessation of the violent vibrations at high rate of speed is owing to the increase of power exerted upon an axle not immovably rigid, which enables the disk to form a true axis of revolution for itself.

The tendency of every body revolving on an axis is to arrange itself around its center of gravity or its true center of revolution. Revolution abhors eccentricity.

If the axis is perfectly rigid there will be thumping. If it is in the least pliable, small eccentricity will be distributed evenly on the unbalanced diameter, but only after the power of increased velocity is great enough to make the mechanical axis vibrate sufficiently to allow within its circles a true axis of revolution. The equalization takes place along the unbalanced diameter in the middle of which the center is found when the velocity overcomes rigidity.

If the eccentricity is $\frac{1}{16}$ of an inch, a piece of chalk would touch the heavy side and not the light one at 300 revolutions, because the force is not sufficient to influence the false axis. Increased to 600 revolutions, the axle yields sufficiently to throw the center of revolution on the unbalanced diameter $\frac{1}{8}$ of an inch near the heavy end. Then both ends of the long diameter would touch the chalk, which it would be necessary, however, to place $\frac{1}{32}$ of an inch nearer the wheel, as the disk of revolution now settles into a smaller circle.

A boy's toy illustrates this. Make an eccentric of a piece of pasteboard with two holes at short equal distances from the center on the balanced diameter. Put an endless string through the holes. Twist the string and make the disk revolve. As long as the string is kept rigid, thumping takes place; when the tension is relaxed and the disk is allowed to make its axis, at once the apparent size lessens by half the measure of eccentricity.

As the circle of revolution of a governor decreases by retardation, so the circle of the unstable eccentric decreases by acceleration. Could any practical use be made of this as a regulator? L. A. S.

Aiken, S. C., March 13, 1890.

Replacement of Broken Truck Bolsters and Draft Springs.

Editor National Car and Locomotive Builder:

I have thought of writing to you quite a while for information upon a clause that has been added to Rule 10 of the revised code of the M. C. B. rules, governing the interchange of freight cars, which has its bearing upon cars owned by private parties or companies, and reads as follows: "Railroad companies shall not be liable for the replacement of broken truck bolsters or 'draft' springs, unless the failure occurs when a car is wrecked."

Now what I want to know is the reading of that clause correct, as intended by the M. C. B. Association? It seems to me that "truck" springs are as liable to break under fair usage as either truck bolsters or "draft" springs. I find at least in my inspection, a great many truck springs with one or more coils or leaves broken, and it appears from fair usage, too.

Why should they make exceptions to truck bolsters and draft springs and not truck springs? It will admit of an argument at least.

If you will please get and give through your valuable journal this information, you will oblige others, I think, as well as greatly oblige, S. M. Maxwell, J. C. I.

[It appears to us that the reading of the clause referred to is precisely as was intended by the members of the M. C. B. A. who made the change. We failed to see the necessity for the change when it was made, and we have had no reason to change our opinion since. If any of our readers who helped to pass the amendment will advance arguments in favor of their action, we shall be glad to publish them.—Ed.]

Railroading on the Michigan Central Forty Years Ago.

Some time ago Mr. C. E. Smart, general master mechanic of the Michigan Central, asked Mr. Henry Hall, the oldest locomotive engineer with the company, to write some particulars about his early experiences on the road. The following is an abbreviated copy of the letter written in answer to this request:

To my much esteemed friend, C. E. Smart:

I think I commenced work for the company April 17, 1847, as fireman on a little Baldwin engine, weight seven tons eight hundred pounds. She had a frame made of wood plated with iron, single drivers, the axle being back of the fire-box, with what was called a "half crank," the wheel forming one end of the crank. The guide bar was single and hollow, and formed the barrel of the pump, and terminated in a vertical air chamber. This air chamber was made in two pieces, joined about midway between the induction and eduction pipes. This joint was a ground joint, as were also the joints of the induction pipe with the bottom of the lower chamber, and the flange of the eduction pipe with the top of the upper chamber; all of these parts were held together by a stirrup with a set screw in its arched top.

The valve motion was given by a single fixed eccentric for each cylinder. The eccentric straps had each two arms attached to them, one above, and one below, and as the driving axle was back of the fire-box, these arms were prolonged backward under the footboard, with a hook on the inner side of the end of each. The rock-shaft had arms above and below its axis, and the hooks of the two rods of each eccentric were moved by hand levers, so as to engage with each arm, thus producing backward or forward gear. There was a little trap to lift in the footboard when necessary to oil.

The engine had no pilot, but there were two pieces of plank running down from the frame in front of the truck wheels, one on each side. The company had six of these; one ten-ton Lowell engine with four drivers, three feet diameter, and two of about fourteen tons, four drivers, I have forgotten what make. They had the old style drop hooks, and no cut-off, and wooden cabs. The others had leather cabs, that could be rolled up on the sides and front, and had two small lights of glass forward, one on each side. The small engines ran the passenger trains, one daily each way. The western terminus was Kalamazoo. Trains ran into Detroit on what was then called the "Chicago road," now Michigan Avenue, the passengers alighting from the cars into the street near Woodward Avenue. The engine house was a two-story building, standing back of where the new city hall now stands. The machinery for making repairs was one hand lathe with a large band wheel and crank, turned by an old gray-haired man by the name of Scott. The coaches were of different lengths, named after stations on the road. The seats had leather cushions, and the backs raised up with a strap across the top to rest the back against. There were no brakes used except the one on the tender. To apply it we let down a long iron lever outside the tank, and stood upon it. Trains were run without time cards; as there was but one passenger train each way, they usually met at one point, but if either one was late, they went on until they did meet; if it was between stations one backed to the nearest siding to pass. Freight trains ran promiscuously. The two large engines did most of the freighting between Kalamazoo and Marshall. The track was considered to be unsafe east of Marshall for such heavy engines, and the small engines did the work. Sometimes one would go to Ann Arbor and return, sometimes to Jackson, and sometimes two or three to Marshall. Engineer was conductor, and fireman was brakeman. When a freight train arrived at a station, the engineer handed the way bills for that place to agent, and the agent unloaded the freight, tended switches and coupled cars. The cars were four wheeled and carried about thirty barrels of flour. An engine would haul from six to eight. There were two men at most of the stations. They sawed all the wood with buck saws, handled all of the freight, wooded and watered all the engines. There were but four bridges between Ypsilanti and Dexter; two near Ypsilanti, one Delhi, and one near Scio; the road following the bank of the river all the way. No night trains were run until the road was completed to New Buffalo.

My first work was filling in the river where the depot and yard now is in Detroit. The next year (1848) new engines began to arrive. First eight-wheel passenger engines, then 10-wheel freight engines. They were from Hinckley & Drury's, Boston, with drop hook and independent cut-off, inside connected; passenger engines, five foot drivers; freight, 3½-foot drivers. There were no steam gauges then, and we used to hold the safety valve down until they carried steam enough to haul the train over the hills. I have no doubt they have carried at times 200 pounds pressure. I once ran one of them from Detroit to Chicago and back to Marshall, all without sleep or rest, being 54 hours on the road. Any one who has never made such a trip, on such an engine, can have but a faint idea of how I suffered for the want of sleep the last six hours of the trip. I had to shake the fireman every time I wanted a fire. He would put in the wood, and by the time the furnace door was shut he was dead asleep. When I made that run I arrived on time at Michigan City, and they wanted a man and engine to go to Chicago after a train of stock. I had to go. I was back to start on time at Michigan City, and had to go on as there was no one else to go.

When trains commenced running from the foot of Third street, Detroit, Time Card No. 1 was issued, being a single sheet, about the size of common note paper. After the road was completed to Lawton (then called Paw Paw), passenger trains ran there and lay over night, leaving for Detroit again next morning. After awhile the road reached New Buffalo; then a night passenger train was put on and the first headlight made its appearance. They burned lard oil, and in cold weather would often freeze up and go out. Freight engines ran nights without a light. When the first conductor was put on freight trains, he had one man with him called a "greaser." His business was to grease the cars along the road, wipe the tender and drivers; he had no braking to do, there being no brakes on the cars for a number of years.

After another period or time the road reached Michigan City. Business was immense. The road had all it could do. Emigrants were coming by the thousands; freight cars were fitted out with benches, and most of them were hauled by freight trains. They went from New Buffalo to Chicago by steamer. After running to Michigan City for a number of years the tail of my train was run into at Buchanan.

Mr. Hall proceeds to give particulars about the collision which was no fault of his, as the conductor neglected to flag the train. But nevertheless, he was recommended by the superintendent to take the first locomotives to the Chicago, Burlington & Quincy, which he did and remained running on that road for about a year. The most notable point made in relation to his experiences on Chicago, Burlington & Quincy was that his engine had the first steam gauge he had ever seen.

He then returned to the Michigan Central, and, to resume his narrative, ran a Lowell engine, called "Wolf Hound," and a passenger train. I ran her two years. She had a six-foot wheel, inside connected, cylinders 16 by 22, link motion, and independent cut-off. She stood so high that she had to have a very short stack, and she trailed her smoke so bad that, unless the wind was strong enough to blow it to one side, I could not see the track, when running at night, from one end of the road to the other, only when standing still at stations. I could not see the fireman in the cab. This is no chestnut. The smoke and steam affected my throat and lungs so badly that I was taken sick and did not do a day's work for more than a year. When I got able to go to work I went to Adrian, and run between Adrian and Detroit one week, and then two weeks to Jackson. Was there about one year when the company got behind three months with their pay; the merchants and grocers refused longer credit, the company wanted to pay in scrip due in six months; grocers and boarding houses refused to take it, and the men struck for their pay, trainmen, shop men and section men, on the whole length of the road. Everything stopped except the mail, which the men carried in a baggage car on time, on main line and branches. In a few days the President of the road arrived from Boston. He called the men together and said, if the men would go to work he would commence paying the next week and would keep on as fast as they could get around until the men were all paid in full. Everything was done according to promise. In about

three months the men were paid in full, and I left there and went to Aurora and went to work for Jaurett.

After making several more changes, Mr. Hall returned to the Michigan Central, where he remained till the present time. He is not running now, but is hale and hearty, and remains on the list of engineers with the option of going to work should he be so inclined. His narrative continues:

I will tell you of some of the things I have seen and of some that I know happened that I did not see. I remember of making a very unpleasant trip once on a little Baldwin called the "Ann Arbor." I was fireman. She had been in the shop for some repairs and was sent out to Ann Arbor with seven or eight empty cars to see how she worked. Something was wrong with the center pin, called then "king bolt," and she ran to one side. We had to back up from Ann Arbor to Ypsilanti, where there was a turntable. We left Ann Arbor late in the afternoon and intended to lay overnight in Ypsilanti. When we got to Geddes she went into the ditch; it was almost dark and had commenced to rain. We hunted up two track men who lived there and went to work on her. You probably have seen a strap railroad; there was no ballast or earth above the mud sills, the ties and rails being all above the ground which made it quite a job to get an engine on. We found a long lever and got some blocks and plank from an old saw-mill that was there, and lifted up the drivers, one at a time and blocked them up, put plank under and got her on. We were wet to the skin. We put her on a side track, and went to a house near by and went to bed. In the morning we slipped on our wet clothes, got breakfast and started again. The track had not been straightened there then, and curved around under the hills, following the river on a curve a mile or more long. I went afoot with an oil can in one hand and a block in the other, and when she would climb the rail I would catch her with the block, oil the rail and try again. When we got to within about fifteen rods of the end of the curve we found a place that we could not pass. We tried every scheme that we could think of, but it was no go. We tried until the train ought to be there from Detroit, and we were obliged to go to Grass Lake, where there was a turn-table, and turn, and start for Detroit. We got as far as Ypsilanti that day, and stayed over night, and went into Detroit next day. I could name a good many trips not much more pleasant.

I was on the road during the great conspiracy, as it was called, when the people used to tear up the track, put on obstructions, uncouple the rails from the switch bars, block the frogs, and commit all the deviltry that the human mind could invent. This was done between Jackson and Grass Lake. When I got to Leoni one morning going west, I found a ten wheeler through the fence into a man's garden, the train staying on the track and running past the engine. We hauled the train back to Grass Lake and put it on the siding and went on. Some one had blocked the frog some way, and it turned the truck at a right-angle with the track, and the engine went through the fence and stopped, right side up, as level as though she was on the track. A short time after I was going east and found a passenger engine a little west of Leoni bottom side up, in a little marsh hole. I saw a number of trains off the track at Michigan Center, but they ran so slow after a while that there was not very much damage done. The road was not chopped out there, and there were tall saplings growing close to the track. On dark nights they would bend one down from each side and fasten the tops together and hang old tin pails loaded with stones and old iron, so that they would strike the stack or front end. At last the company had to run hand cars ahead of night passenger trains between Jackson and Grass Lake.

Before the old strap rail was all taken up, the wooden rails upon which the straps were spiked got to be quite rotten and would not hold a spike, and the ends of the straps would often stand up from four to ten inches or more high. Those that stood from us we did not care about; when they pointed toward us and were very high, we would sit down behind the boiler head and await results. Some of the old engines had a fender that caught the rail and turned it off into the ditch. We never stopped for them unless they got fast on the engines. An engineer on a ten-wheeler running at night was leaning out of a side window when a strap came in at the front window, just missed his shoulder and landed on the tank. It frighted him so that he quit the road in a short time and went to work on a farm. I once saw a strap rail come over the truck wheels and wind around one of the drivers of a passenger engine and leave it in the shape of a wagon wheel tire, and run 50 feet to the fence, and it did not make a scratch on the side rod. I have seen all I want to of strap road, and some very narrow escapes from death. I have seen a collision or wreck of some kind on every three miles of road between Ypsilanti and Michigan City. I have seen four bad collisions on one mile of road. Freight cars had but few, if any, brakes; the telegraph was not used for running trains, and when trains were late they ran feeling for each other, and when running at night no light except a common tin hand lamp. Engineers sometimes went too fast, and, when they wanted to stop, could not.

During all the long years of service for the Michigan Central Company my record stands thus: Was never under the influence of intoxicants on the road or off; tail of train that I was running run into once; never run into tail of any train; never had a collision; never killed a person; never struck a team, and no passenger was ever injured on any train that I ever ran. Taking into consideration the way trains were run, without telegraph, without headlights, running when both trains were late—feeling for each other—without brakes on freight cars, I think it is a record of which any man may feel proud, and I guess the officers of this road can count upon the fingers of one hand all the men they know who have been on an engine 40 years who can show the same record. I have been an employé under every superintendent and master mechanic on the road since the company bought the road from the State, and I do not know of a man now in the employment of the company, in any capacity, that commenced work for them as long ago as I did, yet there may be.

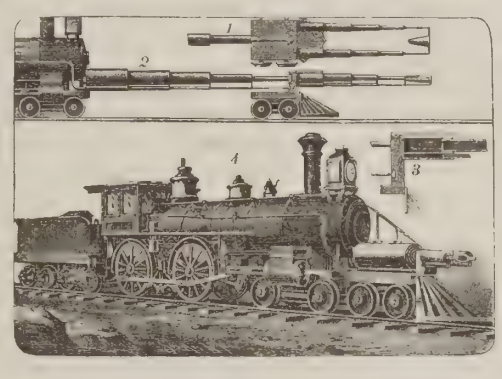
Henry Hall.

Mussey's Safety Pilot.

The *Engineering News*, to which we are indebted for the annexed engraving, says: The critical judgment of our esteemed contemporary, the *Scientific American*, selects the accompanying cut and description as part of the learned food which it lays before its readers in a recent issue. Our readers will, we are sure, find pleasure, if not profit, in studying it, as a fresh evidence of our national aptitude for invention and for conducting scientific journals. We take the liberty of appropriating the *Scientific American's* own description of the device. We cannot improve on it:

A SAFETY PILOT FOR RAILWAY TRAINS.

An apparatus to be attached to and propelled in front of a railway train, to serve as a collapsible cushioning buffer and remove the shock to the train in case of a collision, permitting the train to be brought to a standstill without being injured or derailed, is illustrated herewith, and has been patented by Mr. Norman S. Mussey, of 45 Wall St., New York. The apparatus consists of a series of air chambers connected to telescope together and permit the air to be gradually driven out, and mounted on a suitable rolling support, which may be held near to, or removed some distance in advance of, the train by the folding or unfolding of the telescoping sections. Fig. 1 is a horizontal section, and Fig. 2 a vertical longitudinal section of the extended telescoping portions, Fig. 3 being a sectional view at the meeting point of these portions, and Fig. 4 a perspective view of the invention applied to a locomotive and in folded position. The rear air chamber is attached to the front of the locomotive in any suitable manner.



This chamber is connected by a coupling bar with a rolling support adapted to run on the tracks in front of the locomotive, the bar having a head at one end movable in the central air chamber, and being held from being pulled out of such chamber by a flange at its forward end. The bar has an oval head at its forward end, to turn in a socket secured in an upright on the front of the rolling supports. Any desired number of air chambers may be employed, five being here shown, and preferably of a length of about 5 ft. each, so that when drawn out they will extend some distance in front of the train. The chambers are of diminishing diameters, from about 2 ft. for the largest one, by means of which a gradually increasing resistance is afforded when the telescoping sections are forced together in the manner contemplated by a collision. The scale of resistence in all the air chambers is regulated by means of holes irregularly located in their rear ends, and in order that the chambers may serve as perfect air cushions, each one is fitted into the succeeding one to form an air-tight piston. The rolling support has a projecting piece, to the sides of which are secured the rear air chambers of a second double series of telescoping air chambers, bars in the two front chambers being connected at their outer ends to lugs on a cone adapted to fit into a recess in the projecting piece on the roller support. In order to move the air chambers into extended position, means are provided by which thus may be effected from the locomotive.

We cheerfully give to Mr. Mussey, of 45 Wall street, New York, this free advertisement of his admirable device, and in order to make its merits still clearer let us show how moderate a pressure is required for the effective working of the apparatus. We will take a pair of trains moving at 40 miles per hour, and weighing 500 tons. There will be 56,800,000 ft.-lbs. of energy stored in those trains, and in order to annihilate this energy and bring the trains to rest within the given distance of some 40 ft. by a resistance beginning at zero and gradually increasing to x, we have by a simple calculation $x = \frac{56{,}800{,}000 \text{ ft. lbs.} \times 2}{40 \text{ ft.}}$ = 2,840,000 lbs., or 1,420 tons, as a final pressure, being 3,170 lbs. per square inch on the end of the final 2 ft. chamber.

It is so simple a matter to generate a pressure of this magnitude during the two-thirds of a second which each train would require to come to rest from 40 miles per hour within the given distance of 40 ft., and to hold the pressure after it is generated, that we need not dwell on many other serious objections which might be raised to this excellent device.

Heavy Consolidation Locomotive.

The Rhode Island Locomotive Works have lately built a very heavy consolidation locomotive for the Denver, Texas & Fort Worth, which has been hauling heavy freight trains on the New York, Providence & Boston. After it is tested to the satisfaction of the New York, Providence & Boston road, it will be disconnected and shipped to Chicago, where it will be again connected up and tested on the Chicago, Milwaukee & St. Paul, in connection with their large 10-wheel engines, a number of which were built at the Rhode Island Locomotive Works. After that it will be placed on the Minneapolis, St. Paul & Sault Ste. Marie Railway, and there tested against some very large engines, and after these tests it will be put in the Chicago, St. Paul & Kansas City to run in opposition to some of the large mogul locomotives between St. Paul and Chicago. After these tests are over, the machine will be disconnected and freighted to its destination. The engine is a very powerful machine, and good accounts are expected of it in its very extensive and, doubtless, very thorough tests. The engine has cylinders 20 inches in diameter and 24-inch stroke, drivers 50 inches in diameter; driving-wheel base of 15 feet; total wheel base of engine, 22 feet 6 inches; wheel base of engine and tender, 49 feet 9¼ inches. The total weight of the engine in working order is about 122,000 pounds; weight on drivers, about 109,500 pounds; on pony truck, about 12,500. The weight of tender is about 75,000, and its tank capacity is 4,200 gallons. The boiler is of homogeneous steel 9-16 inch thick, riveted with 15-16 inch rivets, and is calked within and without. The waist is 62 inches in diameter at smoke-box end, made wagon top, with extension arch. The 246 tubes are of charcoal iron, 2 inches outside diameter and 13 feet 8 inches long. The fire-box is Otis steel, 108¼ inches by 33¼ inches. The crown is supported by radial stays 1 inch in diameter. Cast-iron rocking and dumping grates suitable to bituminous coal are used. The Rhode Island Locomotive Works balanced valve is used in the steam chest, piston heads have cast-iron spring ring packing, piston rods of twisted iron, and the Laird guide and crosshead are used. Driver ties are of standard steel, 3 inches thick; the first and fourth pairs are flanged, and the second and third pairs are 6½ inches wide. Driving axle journals are 7½ × 8 inches. The rods are of hammered iron, the parallel rods being put up with solid ends. Sellers' injectors, placed right and left, feed the boiler. Two-wheeled truck under the front end swings from a radius bar. The wheels are Paige, steel tired and 30 inches diameter. The engine is fitted with Westinghouse brake for tender and train.

Increasing Demand for Signals.

The progress into use of the automatic block signal system has been very rapid during the last two years, and the tendency to adopt this measure of handling trains safely is highly encouraging. The Union Switch and Signal Company are now getting out the apparatus to equip seven miles of the Central Railroad of New Jersey, and seven miles of the New York, New Haven & Hartford. The Pennsylvania Railroad Company are reported to be figuring on putting in the system on the 89 miles of their New York & Philadelphia division. There is a strong likelihood that the Chicago, Burlington & Quincy will within the year protect two and a half miles out of Chicago with the automatic block system, and more surprising still is the news that the Illinois Central are considering the cost of equipping their line with the system as far as Pullman, a distance of 17 miles. The Illinois Central has been wakening up lately, and the management appears determined to enter lines of progress to which the road has been an entire stranger.

The attention of the principal English railway companies has recently been directed to a new system of heating railway carriages, and a trial of it will shortly be made on one of the lines running from London to the Midlands. The scheme is to have copper pipes running through each carriage, the connections between the vehicles being formed of india rubber, which can be undone at will, and to keep them constantly filled with steam from the engine. It is held that by this plan the temperature in the carriages may be maintained unvaried during a long journey, and passengers relieved from the discomforts of the present rudimentary and unsatisfactory system. This steam-pipe system of heating trains has been in use for some time on several of the German lines, and it is claimed for it that it is efficacious as well as inexpensive.—*Practical Engineer.*

Dübs & Co., of Glasgow, have recently built some passenger engines for the Waterford & Limerick Railway which are unusually heavy for the British Isles. The cylinders are 17 × 24 inches, two pairs of coupled wheels 6 feet diameter, working boiler pressure, 150 pounds; heating surface, 1,110 square feet. The weight of engine is 81,676 pounds, of which 55,412 pounds are on the drivers.

A combination sleeping and hotel car is being fitted up at the Columbus shops of the Pennsylvania Company for the use of linemen while on duty along the road. A porter and cook will travel with the car.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

APRIL, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Grinding Appliances in Railroad Shops.

American workshop managers have been famous for the success they have achieved in developing the productive capabilities of tools. Competition in trade and the demand for turning out finished work at the lowest possible cost have forced them into the scheming of methods to increase the capacity of tools, and ingenuity has apparently in most cases progressed to the extent of possibilities. There is one shop tool, however, that has been the object of considerable neglect, although after the anvil it is undoubtedly the oldest appliance used for shaping metal. We refer, of course, to the grindstone. The use of the grindstone is as old as the most primitive operations in the mechanic arts, and a revival or revolution of its application to mechanical operations has taken place within thirty years; yet the grindstone and its progeny the emery wheel seldom hold the important place in shop operations that their merit entitles them to. Although the grindstone and the emery wheel are the most profitable tools in many great manufacturing establishments, in railroad shops their value is nearly always underrated, and there is a decided tendency to regard the work to be done by them as being of a rough, coarse character, calling for the exercise of little skill or ability from the workman. There are some shops where the grinding-room is rated at its proper value, and in such cases nearly all finishing of surfaces is done by grinding, with very material reduction in cost. If the heads of our mechanical departments would visit the shops where grinding is done with the best appliances by skillful workmen, we are persuaded that a new revival of the use of grinding apparatus would soon take place.

Grinding is eminently adapted for two processes that are wide apart. It pays well in rough operations on hard material and on fine operations that give perfect finish. The process has its place, and those who have used grinding appliances most are well posted on what lines of work it will pay, so that men thinking of extending the work of the grindstone and emery wheel need not make mistakes by applying them to work for which they are not adapted, if they will only consult with some of the many mechanics who are experts on the value and proper use of grinding appliances. It is probable that the limited use of proper grinding tools in railroad shops is due to mistakes made in applying this kind of machinery to processes to which it was not adapted. We have often seen emery wheels used on the last kind of work that we would have thought of applying it to. In a very interesting lecture on Emery Wheels, delivered by Mr. T. Dunkin Paret before the Franklin Institute, extracts from which are published in another part of this paper, the author speaks of the emery wheel's action as being equivalent to that of a file passing over the work at the rate of a mile a minute, while a file pushed by hand goes over the work at a speed of about 60 feet per minute. To make the work of the emery wheel effective, it is necessary that means should be provided to clean off the material as fast as it is removed, or instead of continuing the cutting action the minute teeth on the periphery of the wheel will perform the useless work of pulverizing to fine dust the material cut from the metal. When this takes place, and it happens very often, the men in charge come to look upon grinding appliances as less effective than they are reputed to be. In such cases the trouble is not with the apparatus, but with the men in charge, who fail to give the machine the opportunity to perform its work satisfactorily. If a man filing a piece of work lets his file fill up with cuttings, it ceases to do work efficiently, but a capable workman keeps his file clean. A modification of the same treatment is necessary with the emery file that moves at the rate of a mile a minute.

We would commend any of our readers who are trying to make their grinding appliances more efficient to obtain a copy of the lecture we have already alluded to and study its contents carefully. Mr. Paret is an expert on grinding apparatus, and has given the subject profound study besides the most extended kind of practical application. There are very few men in charge of grinding apparatus who would not profit by the information given in this excellent lecture.

The sentiments that consign the grindstones and the emery wheels to the dirtiest and darkest corner of the shop, and put the stupidest man in the establishment in charge of them, prevent this part of the machinery from receiving the thoughtful attention required to make the best of everything. There are good and bad emery wheels just as there are different degrees of merit among all makes of tools, but there has been too little attention bestowed upon finding out which is the good and which the inferior emery wheel and what is the cause of the difference. Few foremen appear to care more for grinding machinery than merely see that it is kept in running order, and by this means the most efficient tools for many purposes are rendered almost worthless. Such men ought to profit by the words of an expert on grinding machinery, who says: "The particles or grains of quartz, emery, or corundum sand, of which abrading wheels are composed, project above the surface like the teeth of a file or rasp. These teeth or cutters are embedded in or held by glutinous, silicious, or other cementing material, which may be compared to the fastening of a tool or the setting of a diamond. These edges or projections scrape away the material ground off, and the main point in all grinding, not to include the truth of movement, is in getting rid of the displaced particles. In moving for a half inch there may be room in some cases for dust or ground-off particles to be carried in front of the teeth, without being so closely packed as to remain fastened on the surface, and cause glazing, or filling as it is called; but to exceed this limit ever so little, may pack the stone or wheel. The more friable the material to be ground the more free will be the escape of the dust, and the harder the particles are, and the more crystalline their structure, the less liable they will be to pack the face of the wheels; hence hardened steel can be more easily ground on emery wheels than soft iron can." A reflective man can make good use of the hints given.

Air Brakes for Freight Cars.

A very gratifying item of railroad rolling stock news of last month was the announcement that the Chicago, Burlington & Quincy had ordered air brakes for 6,750 freight cars. Those interested in the cause of humanity will rejoice on account of this highly progressive movement on the part of the company named, since it will exempt many men from the highly dangerous ordeal of climbing over slippery cars swaying from side to side, as trains rush through the storms and darkness that to such a great extent prevail while freight trains are on the road. The application of air brakes to the large number of cars constituting the order will prevent no small amount of death and suffering, and 10 years hence hundreds of men will be performing useful duties to themselves, their families and to the country who, but for this life-saving change, would be in their graves. The deadly car coupler has become a by-word and a reproach of railroad operating for the suffering it causes, but its many victims, if maimed, generally live as mutilated monuments of a dangerous occupation; but accidents that happen to brakemen who fall from the tops of cars or are struck by bridges nearly always end fatally, The higher speed of freight trains made necessary to handle large numbers of cars during busy seasons, and the growing practice of changing road crossings from the level to overhead at the call of public sentiment, have been the means of increasing the dangers of a brakeman's occupation. This makes it all the more gratifying to find a great railroad company making use of the mechanical appliances that will put an end to this source of danger.

Railroad managers are certainly not behind private individuals in making provision for the safety of the employés under their charge, but it is doubtful if humanitarian or sentimental considerations have so much to do with the application of power brakes as the business inducement that the improvement pays. Equipping freight cars with air brakes increases the earning capacity of rolling stock so materially that an increase of net earnings results which proves the expenditure to be of the kind that brings back lucrative returns. When the engineer has in his hands the means of controlling the train, the average train speed can be so much accelerated with safety that not only the cars but the track have their money-earning capacity increased in proportion to the greater volume of business transacted. Railroads that are chronically blocked with cars waiting to be moved can quickly be freed from the delays and confusion of overgrown business when the speed of trains is increased 25 per cent. If provision had been made to run trains safely at higher speed, many roads that were doubled tracked as a means of handling the business, might have for years avoided the heavy expenditure.

There is another very important reason why it is good business policy to equip freight trains with continuous brakes. Nearly all railroads are built undulatory, with heavy ascents following descending grades of about the same steepness. If trains can be safely run down the descending grade at high speed the momentum, as every trainman knows, will greatly help the work of taking the train up the hill that follows. Where hand brakes are used, it is often unsafe to "run for the hills," because places frequently intervene that must be approached with the train under complete control. When this is the case the hauling capacity of the freight locomotives is seriously reduced, and the work of hauling the trains up the grades is done at a much higher expenditure of fuel than what is necessary when the momentum of the train is utilized. Some very well digested information on this subject will be found in "Wellington's Railway Location," which railroad managers who have never performed the duties of trainmen might do well to study.

In addition to the benefits enumerated as being derived by railroad companies from the use of continuous brakes on freight trains, there is yet to be mentioned the saving that results from the prevention of train accidents. To estimate this properly a comparison must be made between the uniform exemption from accidents of passenger trains since air brakes were introduced with the condition of matters when hand brakes had to be depended upon. To properly realize the extent of prevention of accidents exerted by good air brakes, one must be for a few years in close contact with the operating of trains to witness the numerous narrow escapes from collision that would not be escapes were a powerful brake not at the hand of the engineer. When all the advantages to be derived from the use of continuous brakes are considered, the matter of surprise is, not that enterprising railroad companies should adopt the improvement for their freight equipment, but that so many railroad managers are to be found who consider that they can afford to do without it.

Sending Locomotives to Exhibitions.

The committee in charge of railway rolling stock for a great industrial exhibition to be held at Edinburgh, Scotland, next year, have been making great efforts to induce some American locomotive builder to send an engine to the exhibition, and as a special inducement the offer was made to arrange for a competition between the American locomotive and some of the engines running on leading British railways. As European railroad companies are all satisfied that their own designs of locomotives suit them better than those in favor on this side of the Atlantic, and as there is no likelihood of changing their opinions, American locomotive builders do not see wherein it would pay them to send a locomotive to Scotland for exhibition or for competition, so there has been no disposition displayed to accept the offer. The Edinburgh exhibition officials have now become so earnest in the matter that they have made an offer to pay the expenses necessary for taking an American locomotive to Scotland. There is, we understand, some likelihood of the Baldwin Locomotive Works agreeing to send an engine under the new terms offered.

It appears to us that our first class railroad companies have displayed remarkably small enterprise in permitting the exhibition authorities to wave a flag of defiance to American locomotives without a response. We cannot think of anything that would be such a good paying investment for such a company as the New York Central as the sending of one of their first class locomotives for exhibition at Edinburgh, and for competition with anything of British build that could be run against it. No matter how the contest came out the railroad company would have their reward of unlimited advertising. There is every reason to believe that the increase of business from foreign travel alone would be soon sufficient to repay the railroad company the expenses incurred, then it would be the very best kind of an advertisement for home business. There is a wide spread belief among foreigners that the Pennsylvania Railroad is the only first class railway in America, and Mr. Depew's friendly intercourse with foreign dignitaries has done very little to dispel this fallacy. But the popular talk and the newspaper celebrity which would be obtained by the company sending for exhibition examples of the fine engines used in moving the trains of the New York Central, would place the railway on its proper footing in public estimation. It has been a regular practice in Europe for railroad companies to display their rolling stock and machinery at the various exhibitions, and railroad companies in that part of the world are not in the habit of spending their earnings on gratuitous show. Then the question arises, why do the railroad companies constitute such large exhibitors at the various exhibitions? The answer is that exhibiting the first class machinery used is a medium of advertising which brings back bounteous returns.

The Pennsylvania Railroad Company appeared to display considerable enterprise in importing a Webb compound locomotive from England. Does any one familiar

with engineering matters imagine that it was necessary to bring a locomotive from abroad to demonstrate the value or otherwise of the compound principle? Not at all. The Webb compound has made a very sorry record compared with the Michigan Central locomotive of home manufacture, but there is no doubt that the bringing over the foreign locomotive was an enterprise that paid the railroad company, although the engine has spent the greater part of the time in the repair shop and round house. The traveling public do not know this, and they are induced to patronize the railroad that is able to boast of its great enterprise. Railroads are very much like shows and stores. Those that do the most advertising and do it judiciously get the greatest patronage, everything else being equal.

Power for Reversing Locomotives.

A correspondent in another page has a word to say in favor of steam reverse gear for locomotives, which appears to us very seasonable. A striking feature about the locomotives built last year was their great weight, and yet we do not remember noticing that the specifications for a single locomotive called for steam or power reversing gear. Some years ago a few roads began putting steam reversing gear on their heavy passenger locomotives. The apparatus was not costly, and it was quite efficient without being expensive to maintain, yet some of the companies that formerly equipped their engines with reverse gear have ceased doing so. The cause which we have heard assigned for this action is that the men handling the engines regarded the reversing gear as being of little value. Nearly all passenger locomotives on the roads where the steam reverse gear is used are now equipped with balanced valves which makes the work of reversing and linking up the valve gear very light, so the men in charge would rather do the work of moving the reverse lever than look after and keep in working order a steam reversing gear.

It appears to us that the power reversing gear was put on the wrong class of locomotives. The engineer of a passenger locomotive is the aristocrat of his calling, and when any new attachment or improvement for locomotives is proposed he is pretty certain to get the first opportunity of trying it, and his opinion very often leads to the adoption or causes the rejection of the device. The engineer of a passenger locomotive is required to reverse his engine so seldom that it matters little to him how hard the work of reversing may be. The engines that ought to be provided with power reversing gear are the heavy freight locomotives that have long reaching eccentric rods, weighty links, and long ports with valves that carry an immense load of steam pressure. Balanced valves have done much to lighten an engineer's work in reversing locomotives of this character, but the work is still very laborious, and is almost more than human endurance is equal to in hot weather when much switching has to be done. Had engines of this kind and the large switching engines now coming into favor been provided with power reversing gear we make safe to assert that the engineers would not have reported the device to be a useless superfluity. There are several kinds of steam reversing apparatus in use, but we do not think that one as simple as might be devised has been put upon the market. There is here still a good opportunity for the work of inventors and of manufacturers of railroad appliances.

The Latest Hamburg Massacre.

The Lake Shore & Michigan Southern Railway has been unfortunate in having appalling accidents to passenger trains, and the vicinity of Hamburg, N. Y., has been the most fatal locality on the road. Another sanguinary accident happened there early last month through the hind end of a passenger train crushing into the front end after a break in two. This, of course, could not happen had the automatic air brake been connected and in working order, but the conductor of the train was guilty of the highly reckless act of cutting the air off the five last cars in a train of ten coaches after a break in two occurred, which tore away an air brake hose. This happened at Dunkirk to an east-bound passenger train at night, and the conductor decided to proceed with the train in this dangerous condition rather than wait until a car repairer, who was on the spot, could put on a new air hose. The train proceeded about thirty miles eastward to the vicinity of Hamburg, when the defective coupling, which caused the first parting of the train, failed again on a slightly descending grade and the front part of the train shot ahead, leaving an opening. When the break was discovered the front portion of the train was about half a mile away from the detached part. The part of care and good sense then was to keep the front part of the train running; but there appears to have been little sense connected with the control of the train, and, accordingly, the worst possible action was taken—the train was stopped by opening a conductor's valve. There is a conflict of testimony as to who opened this valve. The conductor signaled the engineer to stop by two pulls of the bell, but the opening of the air valve brought the train to rest before the engineer could act. The front part of the train was no sooner stopped than the conductor realized the peril from the broken away portion, and he signaled the engineer to pull ahead; but the open air valve in the train prevented the engineer from releasing the brakes, so the train could not be moved, and the detached cars crushed into the part of the train that was stopped. The lighter cars were telescoped by the heavier ones, and six persons were instantly killed, while seventeen others were severely injured.

When a number of people are suddenly killed or injured in any railway accident, the natural inference is that some person or persons are to blame, and they will be held responsible for their misdeeds. Few railroad accidents have happened where the blame could be so easily located as in this last Hamburg massacre, yet it looks as if the authorities, whose duty it is to enforce the laws of New York State, regard the killing and maiming of railroad passengers as a very light form of transgression. The coroner's jury have as usual held their perfunctory investigation, and as a result the conductor stands accused of having committed a misdemeanor, and the Railroad Commissioners have made their investigation, and have mildly censured conductor and engineer.

The investigation of the cause of railroad accidents is nothing better than a grave and serious farce, that is calculated to encourage reckless railroad companies and careless employés to persist in their death-dealing courses. A fact which had a material bearing on the accident was not brought out by coroner or by railroad commissioners, viz.: that the train did not have a safe and proper signal system in use. When a passenger train has more than five or six cars, the bell-rope is not a reliable means of communication between conductor and engineer, for the surging of the train or swinging round curves often rings the gong in the cab, and the engineer gets in the habit of ignoring what is the signal for a broken train. For this condition of the train, President Newell, of the Lake Shore, was responsible. As the railroad is managed on the personally conducted one-man-responsible-for-everything plan, that man ought to have been made to answer for his share of the blame. The conductor could not have acted more recklessly and senselessly had he left the train and gone to bed in the nearest hotel after giving the engineer the signal to start from Dunkirk. Half of a long train deprived of air is admittedly in a dangerous condition even if there were no likelihood of difficulty with the car couplings. A capable man in charge would have had all the trainmen on the alert to do their best if another break away happened, but the conductor of the Lake Shore train took no extra precaution and the train proceeded with the employés in their usual semi-somnambulic condition. Justice requires that the grand jury of the district take cognizance of this terrible accident, and that more men than the incompetent conductor be held for their share of the blame.

Efficiency of Steam Engines.

Diminished consumption of coal to perform a given measure of mechanical work has steadily kept pace with the increase of boiler pressures. The first steam engine of which there is a record of the mechanical work done was the Newcomen atmospheric engine, in which steam of about the same pressure as the atmosphere was used. This engine raised 105,000 pounds of water one foot high for every pound of good coal used in steam making. Smeaton, the first improver of the atmospheric engine, raised the steam pressure to eight pounds per square inch, and increased the duty to 120,000 foot pounds. Others still further increased the steam pressure, and Watt found the atmospheric engine performing a duty of 200,000 foot pounds per pound of coal. By using a separate condenser, Watt increased the duty to 320,000 foot pounds per pound of coal when the steam pressure was 10 pounds. To-day, Cornish engines of the same general plan as those used by Watt, but worked with 60 pounds pressure, expanding three to six times, perform a duty of 600,000 foot pounds. Our best modern compound engines with boilers carrying steam of 150 pounds pressure perform a duty of over 1,200,000 foot pounds per pound of fuel used. A locomotive using steam to the very best advantage performs about 700,000 foot pounds of work per pound of coal consumed. This high duty is, however, quite exceptional. The elevated railroad locomotives, of New York, of whose work an accurate calculation can readily be made, perform about 330,000 foot pounds of work per pound of good anthracite coal consumed. The cause of this lack of economy is the habitual working of the engines at nearly half stroke cut-off, a practice made necessary by the heavy work that the comparatively small engines have to perform.

The Swinerton Principle on Elevated Railroad Locomotives.

We have repeatedly commented on the attempt by the so-called inventors of the Swinerton locomotive to increase the adhesive power of locomotives by milling flat facets across the tread of the driving wheels. An engine was specially built with a single pair of driving wheels, having the tires finished in this way, and numerous tests were made with the engine on the Boston & Maine Railroad, and not a few men of established mechanical reputation expressed themselves to the effect that the invention was an improvement. When anything new comes out in the railroad rolling stock line, those interested may be depended upon to insist that it is just the thing the proprietors of elevated railroads have been sitting up nights looking for. This being the case, it was only a matter of time for the Swinerton people to reach the Manhattan Elevated Company, and the necessary work was put in to get a trial of the principle ordered. One of the ordinary locomotives belonging to the company had the facets milled on the tires and the engine went into service about a month ago. Of course the officers of the railroad company were closely watching the performance of the latest invention that was to bring millions to those controlling the patent.

When the engine started out the man at the throttle freely expressed the opinion that she slipped worse than she did before the change was made. One trip demonstrated that the principle would not do on an elevated railroad, for the wheels made so much noise in rolling on the iron structure that the thing would have been declared a nuisance. It is reported that Col. Hain, general manager of the railroad company, was about to order the engine out of service, to have the tires turned up smooth, but that after making a few trips the facet edges got rounded off sufficiently to make the tire-tread round, and then there was no more trouble with the noise. The engine pulled the trains without difficulty and with no less freedom than before the tires were milled, and we suppose that this will be published as a proof of the shining success of the Swinerton principle.

The Western Railway Club has agreed to adopt a new arrangement in the publication of the proceedings. The stenographer's report of the discussions will be submitted to the individual speakers for correction before the proceedings are published, and then the publication will be in pamphlet form. No report of the proceedings will be given to the railroad journals till the official pamphlet is published. As this pamphlet cannot reach us in time to publish the proceedings of the past month, we are practically prevented from putting before our readers reports of the Western Railway Club meetings, for they are not of sufficient general interest to call for publication after they are six weeks old. Some members of the Western Railway Club have always raised strong objections to ordinary reports of the proceedings being published. Perhaps the extrordinary reports that will appear after the members have been permitted to make out what they ought to have said as having been said may militate to the advantage of the club and of railroad interests, but we doubt it. We can to a great extent sympathize with the members who object to any reports of the club proceedings being made public, and we were not surprised to see the issue of publication or no publication raised. But we are very much surprised at the curious decision arrived at, and cannot understand how the sensible men who constitute the Western Railway Club came to decide that the proceedings must be subjected to a cooking process before they are fit for publication. Divested of superfluous verbiage, that, we understand is the true meaning of the report containing the decision.

President D. J. Mackey, of the Evansville & Terre Haute Railroad system, has issued an order requiring all officers and other employés to be on duty ready for business every morning at 7 o'clock sharp. The order is aimed at officers and clerks who are not paid for overtime, and who have been in the habit of beginning work a little later than the mechanics, who do not work a minute after quitting time without demanding extra pay. In issuing his order, Mr. Mackey indulges in some plausible reflections about the losses due to a few minutes' idleness where a great many men are employed, but he carefully avoids figuring up what the cost would be if he was required to pay overtime to the army of officers and clerks who do extra work in busy seasons, and many of whom are really never off duty. There is such a thing as killing the natural zeal of men for their business by irritating exactions, and we believe that Mr. Mackey is performing this expensive form of violence. The great mass of railroad officers do their duties conscientiously, and devote cheerfully hours to thinking over and scheming in the interests of their work that are supposed to be given up to idleness or private business. There is no better way of making such people indifferent and lukewarm toward the interests of their employers than by issuing public orders abolishing any small privileges they may have enjoyed.

The Executive Committee of the Railway Master Mechanics' Association have sent out the following notice to members, with a slip for returning a letter ballot:

"We regret to learn that the Lookout Mountain Hotel at Chattanooga, where we had decided to hold the next annual convention, is not far enough advanced toward completion to justify us in depending upon it to furnish the necessary accommodation for the convention. As the cities of Buffalo and Montreal, the alternative places selected for the convention, are very far from Old Point Comfort, Va., where the Master Car-Builders' Convention will meet, and which will be attended by many of our members, we believe it to be desirable to give the members the opportunity to vote on a new place of meeting. We therefore request that members record their votes on the annexed slip, and return it to the Secretary as soon as possible.'

The members have responded by voting by a large majority to hold the convention at Old Point Comfort. Quite a number of votes have been cast for Montreal, and it takes the second place in the choice of the members. A curious thing about the votes in favor of Montreal was that the greater part of them were given by Southern members,

Personal.

We are informed that Mr. Clem. Hackney has associated himself with the Standard Journal Bearing Co., of Chicago, as president and general manager.

Mr. Henry H. Kingston has been appointed to succeed Mr. S. C. Stanton, resigned, as general manager of the Pennsylvania, Poughkeepsie & Boston road.

Mr. D. M. Gugel has resigned as master mechanic of the Central of Georgia shops at Macon, Ga., and has been presented with a gold watch by the employés of the shops.

Mr. William Kent, a well-known mechanical engineer, has accepted the agency for New York of the Pittsburgh Testing Laboratory. Mr. Kent is an expert in metallurgical science.

Mr. Edward W. Morris, road foreman of engines of the Jefferson, Madison & Indianapolis, has been appointed superintendent of motive power of the Louisville, New Albany & Chicago.

Egbert P. Watson, Jr., one of the editors and proprietors of *The Engineer*, of New York, died on Feb. 25, of Bright's disease. Mr. Watson was a young man of decided ability and high promise.

Mr. George Gage has been appointed master mechanic of the Pennsylvania, Poughkeepsie & Boston. Mr. Gage was for many years a locomotive engineer on the Western division of the Erie.

Mr. A. L. Humphrey, general master mechanic of the Colorado Midland, was married last month, and a "grievance committee" of the road took advantage of the occasion to present him with sundry handsome presents.

His numerous railroad friends will be glad to learn that Mr. H. S. Bryan has returned to railroad work. He has been appointed master mechanic of the Duluth & Iron Range Railroad, with headquarters at Two Harbors, Mich.

Mr. J. M. Lowry, who was so long master mechanic of the Chicago, Milwaukee & St. Paul Railroad, died at Milwaukee last month. Mr. Lowry was born in England and learned the machinist trade in the Stephenson locomotive works at Newcastle.

Mr. G. R. Joughins has been appointed master mechanic in charge of rolling stock and floating equipment of the Norfolk Southern. Mr. Joughins has been for some years on the Lake Erie and Huron, and is a remarkably well trained mechanical engineer.

The engineers and trainmen of the Cincinnati, New Orleans & Texas Pacific presented Mr. James Meehan, superintendent of motive power, with a handsome diamond stud. At the same time, they gave Mrs. Meehan the gift of a handsome set of silverware.

Mr. E. V. Sedgwick has been appointed master mechanic of the Mexican National, with headquarters at San Luis Potosi, Mexico. Mr. Sedgwick was for some time master mechanic of the Duluth, South Shore & Atlantic. He also had some previous experience in Mexico.

Mr. J. A. Barnard, who has been appointed assistant general manager of the Cleveland, Cincinnati, Chicago & St. Louis, was for some time purchasing agent of the Ohio & Mississippi and is a son of President Barnard, of that road. He is reported likely soon to become the son-in-law of President Ingalls.

The recent changes among the higher officers of the New York Central Railroad, whereby Mr. H. Walter Webb was made third vice-president, led to the removal of Mr. A. G. Leonard from Mr. Buchanan's office to that of Mr. Webb. Mr. Leonard has been assistant to Mr. Buchanan for several years, and is highly popular.

Mr. Frank S. Gannon, general superintendent of the Staten Island Rapid Transit road, has been appointed to take charge of the Baltimore & Ohio interests east of Philadelphia, with the title of Eastern general superintendent. This is in addition to his duties as general superintendent of the Staten Island Rapid Transit.

Mr. George W. Saul, formerly general manager of the Fort Wayne, Cincinnati & Louisville, has been appointed general manager of the recently consolidated Chicago & Eastern Illinois and Mackey systems of roads. Mr. Saul was for some time purchasing agent of the Cincinnati, Hamilton & Dayton, and first made his mark there.

Railroad mechanical men will be pleased to hear that Mr. J. L. Greatsinger, master mechanic of the Duluth & Iron Range Railroad, has been appointed general superintendent. Mr. Greatsinger was highly popular among the friends he met at the last master mechanics' convention, and they will all be pleased to hear of his good fortune.

The report has reached us that Mr. Elliot Holbrook, general superintendent of the Pittsburgh & Lake Erie, has resigned. Mr. Holbrook rose in railroad service through the engineering department, and is reputed a highly efficient officer. It is, however, said that he did not suit President Newell, as he was too strong a man to be made a cipher of.

Mr. W. F. Black, Superintendent of the Jefferson, Madison & Indianapolis division of the Pennsylvania lines, has, through the Pennsylvania interests, been made general manager of the Louisville, New Albany & Chicago. Mr. Black, who is 37 years of age, entered the employ of one of the Pennsylvania lines as a telegraph operator. He rose rapidly to the position of superintendent.

Mr. Albert Griggs, one of the vice-presidents of the Railway Master Mechanics' Association has, been appointed superintendent of motive power of the New York & New England Railroad. Mr. Griggs gained an enviable celebrity when on the Providence & Worcester for his able management of his department, and his many friends will be pleased to hear of the greater opportunities offered to his ability on the larger railroad system.

Mr. Lucius Tuttle, who has been appointed general manager of the New York, New Haven & Hartford, entered railroad service as a clerk on that road. He rose through the passenger department to important positions, and was for some time connected with the Grand Trunk Railway. It is understood that Mr. Tuttle's duties will be confined to traffic matters, and that all details of operating and equipment will be managed by President Clark, as usual.

Mr. James McCrea, general manager of the Pennsylvania lines west of Pittsburgh, has been elected second vice-president of the company. Mr. McCrea has risen step by step on the Pennsylvania system, from the position of a rodman of the engineering department. He is a highly practical and efficient officer, there being few details of railroad work with which he is not personally familiar. He has odd views about some things, but is free of access and popular among those under him.

Numerous railroad officers and supply men have heard with sincere regret of the death of Mr. C. D. W. Gibson, of the Ramapo Iron Works. Mr. Gibson had, in the early days of its existence, a connection with this journal, and he always displayed a warm interest in its prosperity. He was a warm-hearted, genial gentleman, of strictly correct habits and high principles. These qualities made friends for him wherever he went, and his absence from the haunts of railroad supply men will be sadly felt.

Master Mechanic McKenna, of the Indianapolis, Decatur & Western road, has two model cabooses of his own design. The cabooses are fitted up with sleeping accommodations for four men, wash room, and all conveniences found in an ordinary boarding house, which will be very convenient when the trainmen are obliged to lay over at a terminal. These cabooses are 34 feet long, rest on two four-wheeled trucks, and are so arranged that a brakeman can go to the top of his train without climbing up the sides or over the ends.

Major George D. Lawrence, manager of the Romé & Decatur since last June, has been appointed superintendent of the New Orleans Division of the Louisville, New Orleans & Texas, to succeed Mr. A. A. Sharp, resigned. Major Lawrence was formerly connected with the Chattanooga, Rome & Columbus as superintendent, and for a short time with the East Tennessee, Virginia & Georgia as general agent. Mr. Sharp has been connected with the road since 1882 as superintendent of construction, superintendent of transportation and division superintendent.

Mr. C. F. Thomas, master mechanic of the Georgia division of the East Tennessee, Virginia & Georgia, has resigned that position to become master mechanic of the Central of Georgia, at Macon, Ga., succeeding Mr. D. M. Gugel. Mr. Thomas has been master mechanic of the East Tennessee, Virginia & Georgia since December, 1885. He has been connected with the mechanical department of various roads since 1875, serving with the Pennsylvania, Louisville & Nashville and Chesapeake & Ohio. Mr. Thomas received the first part of his mechanical training at the Renova shops of the Philadelphia & Erie, where many others who have made their mark on railroad work graduated. Mr. Thomas has long been engaged on sketches of the careers of Renova boys for the National Car and Locomotive Builder, and we feel sure that they will be very interesting.

A Good Location for Manufacturing.

There are very encouraging signs of Richlands, on the Clinch Valley division of the Norfolk & Western, becoming a great and prosperous manufacturing center. There are at present in blast or in process of construction on the line of the Norfolk & Western Railroad 11 blast furnaces, which have an average output from 100 to 125 tons per day each. The Richlands is 40 miles from the nearest of these furnaces and 150 miles from the furthest. The railroad company will give favorable rates on this pig iron going west to the Richlands, as empty coal cars are going in that direction in large numbers. This pig iron is at present being shipped North and is being used for various purposes in mills and foundries, and is giving very great satisfaction. The Clinch Valley division of the Norfolk & Western which passes through the Richlands connects with the Louisville & Nashville at a point about 16 miles west of the Richlands, and the Louisville & Nashville expects to use this route in bringing the Alabama iron to the Eastern market, so that a mill situated at this point would be directly in the line of the cheap Southern irons coming North.

In addition to this there have been large discoveries of iron ore along the line of the Clinch Valley division at points situated from one mile and a half to forty miles distant from the Richlands, so that furnaces established at the Richlands should be able to make iron as cheaply as those located in Alabama, which are estimated to make pig at a cost of from $8 to $10.

The line of the Clinch Valley division of the Norfolk & Western from Richlands west, and of the Charleston, Cincinnati & Chicago, as well as the Ohio extension of the Norfolk & Western, now under contract, pass through a thickly timbered region, which, it is unnecessary to say, has hardly been touched. The prevailing timber is poplar and oak, although there is a considerable amount of the various hard woods. From the close connection of the above roads with the Clinch Valley division, any wood-working industry established at Richlands would be able to count on a large territory from which to draw its supplies.

The New York, Pennsylvania & Ohio Railroad recently placed an order for 500 more 30-ton coal cars. This makes a round thousand ordered during the past summer, 900 of them being 30-ton cars and 100 25-ton cars. The Peninsular Car Company, to which this contract has been let, also has an option on 500 more cars.

Experiments have demonstrated that the relation between the velocity of a projectile and the resistance offered by the air to its motion differs materially from Newton's theory that the resistance is proportional to the square of the velocity. For velocities which are nearly equal to that of sound in air the proportionate increase of the resistance is much greater than that of the velocity. The air resistance to trains at high speed is, of course, the same as the resistance offered to projectiles, and it has been usual to compute it as being proportional to the square of the velocity.

The car trade out of Muskegon has been exceedingly active for the past two or three weeks, and yard dealers are beginning to hope that there may be something that will redeem the past situation. The shipments for February were far in advance of a year ago, as is also the record for March to date. Prices are held firm, and on some scarce grades advancing. The yards are all doing a nice trade, and "kicking" on freights. By the way, C. D. Nelson, an old-time lumberman of Muskegon, is to open a large yard at the mouth of Muskegon Lake this spring. He will be associated with Chicago capitalists. They will establish a planing mill in connection, and expect to do a large business.

The Railroad Commissioners of New South Wales have been negotiating to introduce Pullman cars into the colony, and the movement has raised no small storm of opposition. Mr. Nobbs, a leading man, has made a public protest against the Pullman car scheme. He expresses in strong terms the belief that to give the proposed contract to the Pullman company would prove prejudicial to some of the established industries of this colony, and he mentions in this connection the establishment of Hudson Brothers, Limited, who, he says, are certainly able to turn out carriages fit to run on any line, and have expended a vast amount of capital in bringing their works to such a state of perfection as enables them to do it. Mr. Nobbs considers that before the Railway Commissioners enter into any contract with Mr. Pullman it should be conclusively proved that "the manufacturers of New South Wales are unable or unwilling to similarly supply the rolling stock required, and on terms equally advantageous to the colony." It is understood that Mr. Nobbs' protest will be taken into consideration by the Railway Commissioners.

The Massachusetts Legislative Committee on Streets and Railways gave a protracted hearing last month to expert testimony in favor of special kinds of elevated street railroad structures. The Mack system appeared to have more friends than any other and was very vigorously pushed by its friends. They presented an array of expert testimony which must have its weight upon the minds of the committee, for when men of thirty and forty years' experience declare that a system is "as nearly perfect as anything human can be," and that they do "not see how it could be improved," that system must be possessed of some merit. Among the practical men who indorse the Mack system are John Thompson, formerly of the Eastern Railroad; L. M. Butler, of the New York, Providence & Boston; Orlando Stewart, of the Fitchburg; James K. Taylor, for many years with the Old Colony and Boston & Lowell; George Richards, President of the New England Railroad Club; D. H. Andrews, constructor of the new Harvard bridge to Cambridge; James Henney and J. A. Shinn, of the New York & New England; President Manvel, of the Atchison; George W. Cushing, of the Union Pacific; A. Pilsbury, of the Maine Central; John B. Wilson and A. Watson, of the Duluth, South Shore & Atlantic; J. Earnshaw, civil engineer, of Cincinnati; A. B. Underhill, of the Boston & Albany; James Meehan, of the New Orleans, Texas & Pacific, and James Smith, of the Boston Forge Company. Either men of established reputation in practical mechanics are very free with their expressions of approval, or there is something worthy of indorsement in the Mack system.

Carnegie, Phipps & Co.'s Steel Works.

At the invitation of the firm of Coolbaugh, McMunn & Pomeroy, general agents for Carnegie, Phipps & Co., Pittsburgh, a party of railroad men and others went from New York to Pittsburgh last month to visit the steel works belonging to the company. The visitors were principally interested in the steel used in railroad rolling stock, and the greatest attention was devoted to examining the Homestead Steel Works of Carnegie, Phipps & Co. These works are situated on the south bank of the Monongahela River, some nine miles above Pittsburgh, and on the lines of the Monongahela Division of the Pennsylvania Railroad, and the Pittsburgh, McKeesport & Youghiogheny Railroad, the latter being one of the railroads comprising the Vanderbilt system. The property consists of some 89 acres, of which the works proper occupy about 50 acres of level ground, having a river frontage of some 3,100 feet.

The Bessemer Department of these works comprises a converting mill 119 feet × 73 feet, in which are located six melting cupolas and two 5-ton converters; blooming mill, 187 feet 6 inches × 73 feet, in which are located soaking pits, a powerful blooming train and hydraulic crane for handling ingots, etc.; also structural mills, 33 feet and 23 feet, located in the same building, which is 602 feet × 84 feet, having three wings 80 feet deep. In this building is also located a 10-inch train for rolling spring steel, rivet rods, etc. The two structural mills are devoted exclusively to rolling steel beams, channels, angles and tees. The Bessemer Department is fully equipped with engine houses, boiler houses, mixing house, etc., and all appliances for economical handling of materials.

The Open-Hearth Department.—The open-hearth furnaces, plate train and finishing machinery are housed in the same building. This is 967 feet long and is built entirely of iron and steel. The main building, containing open-hearth plant and the plate-mill proper, is 501 feet long and 86 feet wide in the main span, with a 45-foot lean-to on each side. The inspecting and marking-out department is 273 feet × 43 feet, and the shearing department is 187 feet × 86 feet.

The open-hearth furnaces are eight in number; a new building is now nearly completed, however, which will contain eight more open.hearth furnaces. This building is about 400 feet long × 200 feet wide.

The furnaces all use natural gas as a fuel, the stacks being placed at the back, and the checker-work in the flues preheating the air.

Charging is done from the general floor level. These furnaces are arranged in pairs, with casting pits between each pair. Nos. 2, 3 and 4 are opposite Nos. 7, 6 and 5, respectively.

Between the pairs of furnaces are the hydraulic ladle cranes, which are directly on the center line of the building, and on either side of the cranes are semi-circular pits, capable of taking four sets of molds. Each pair of furnaces are attended at pits by two 7-ton and two 20-ton hydraulic cranes, which command the furnace itself, the casting and ladle pits, and the narrow gauge tracks over which the ingot molds are removed and the product of the furnace is carried to the mill.

At one end of the open-hearth department is a small steel foundry, with core-room, etc., where special steel castings for use at the works are made.

The capacity of the open-hearth plant amounts to 7,500 tons of ingots per month. This output will, of course, be doubled when the new plant, above referred to, is completed.

The slabbing mill building is of steel and iron, 300 feet long and 120 feet wide, with a 35 foot lean-to for boilers.

Eight heating furnaces, vertical pits 6 feet in diameter and 7 feet deep, with circular covers, are arranged in pairs in the northern end of the building. Two 35-ton hydraulic cranes, swung by rack and pinion,and fitted with a simple hydraulic tackle for gripping ingots, charge and draw these furnaces.

The slabbing train itself is a universal mill. The vertical rolls are of steel 20 inches in diameter, and are driven 50 revolutions per minute by a pair of E. P. Allis' 30 inch × 54 inch reversing engine, running 100 revolutions per minute. And the horizontal rolls are 33 inches in diameter, and are driven by a pair of E. P. Allis' 40 inch × 54 inch reversing engines. This train has already dealt with 48-inch × 48-inch ingots, weighing 38,000 pounds, and is capable of taking a 25-ton ingot, 48 inches × 54 inches, and rolling to a section 11 inches × 3 inches.

Tables carry the ingot from the roll train to the shear. Tables on both sides of the rolls are run by a pair of upright 10 × 12 Crane reversing engines, and the shear table by a pair of horizontal 8 × 10 Crane reversing engines.

The shear power is hydraulic and operated by the descent of the upper knife, with a pressure of 4,000 pounds per square inch (given by two Southwark Foundry pressure pumps, 65-inch steam cylinder, 10-inch water cylinder, and 8-foot stroke); the shear develops somewhat over 3,000 tons power, and is capable of shearing a 48 inch × 24 inch section. A general pressure throughout the mill of 500 pounds per square inch is supplied by two Wilson & Snyder's duplex pumps.

In the lean-to are six batteries, of four each, of boilers 44½ inches diameter and 26 feet 6 inches long, supplying the steam pressure of 120 pounds.

Besides the two cranes for handling ingots at the pits, there are in the mill two 16-ton and seven 5-ton slab cranes.

Aside from the ponderous machinery of the roll train, and the great power and simplicity of design of the hydraulic shear, what is particularly striking about the mill are its admirable arrangement and shipping facilities, and the very small number of men required to run it. All slabs from this mill before being shipped away, or sent to the plate mill, are subjected to a thorough inspection. Capacity, 10,000 tons per month.

Plate Mill.—Ingots were formerly roughed and finished in this mill, but are now roughed in the universal mill to slabs, which are brought by small cars directly to the furnaces of the plate mill. Three heating furnaces, 25 feet × 6 feet 9 inches, are located on each side of the mill, charging and drawing being done by special hydraulic cranes, controlled by one man who is carried about on a seat suspended from the jib.

Reheated slabs are placed by these cranes on tables of live rollers, which carry them to the mill. The mill is three-high, the top and bottom rolls being 119 inches long and 32 inches in diameter, and the middle roll 119 inches long and 22 inches in diameter, making fifty revolutions per minute. A 42 × 54 horizontal Mackintosh, Hephill & Co. engine drives the roll train, and screwing down is done by means of a small vertical engine, friction clutches and worm gearing.

From the rolls the finished plates come slowly down a roller table 363 feet long and 5 feet 1¾ inches wide, driven by a line shaft and bevel gearing. An overhead traveling crane runs the full length of the table, so that the plate can be removed at any point, turned over for inspector on the lower side, or shifted to any part of the table or floor as may be desired. On this the plates are allowed to cool, air having free access below the rollers, and are inspected above and below, and stamped as to quality, dimensions, etc., and carefully laid out for shearing. The inspector examines stamping and marks, and stamps test pieces. From the table, plates are rolled on casters to the shears. The casters are small rolls, supported on vertical shafts which are held in holes in the floor. The shearing is done by three shears, each with a knife 135 inches long, and two with 36 inch knives, all built by the Morgan Engineering Company.

The Shipping Department is supplied with sixteen cranes, which place the plates directly on cars on switches of the Pennsylvania Railroad system.

Steam power at 100 pounds pressure is supplied by four batteries of four boilers each. Each boiler is 44 inches in diameter by 24 feet four inches long, with two 16-inch flues; draught being provided by two wrought-iron stacks, 125 feet high. Two duplex Southwark Foundry pumps feed the boilers, and two Southwark Foundry and one Wilson, Snyder & Co. pressure pump with an 18-inch accumulator supply the hydraulic pressure of 500 pounds per square inch. This mill has rolled plates from 3 inches thick, 115 inches wide, down to ⅜ of an inch thick and 117 inches wide, and can handle plates as high as six tons in weight. Capacity, 5,000 net tons per month.

In connection with the plate mill is a special set of rolls for bending plates and beams, capable of bending the largest plate that can be rolled in the mill.

This department is completely equipped with testing apparatus, etc. A very complete chemical laboratory is also attached to these works. Complete machine and blacksmith shops are included in this category.

Yards.—The yard service of the works includes three standard gauge engines and six narrow gauge engines of various sizes. There are nine miles of railroad track in the works. In addition to a number of hand and hydraulic cranes in the various shipping departments, there are four 10,000 pound and two 5,000 pound Yale & Towne locomotive cranes.

The water supply for the mills is pumped from the Monongahela River.

System.—The works are in charge of a general superintendent. Each mill or department has its particular superintendent, under whom, in turn, are his various clerks and foremen. The mills are run night and day.

The yearly pay rolls amount to, approximately, two millions of dollars. Number of men employed, 2,500.

After making a very thorough examination of these works the party went to the Edgar Thompson Steel Works, at Braddock, and made a brief inspection of that establishment. The greater part of the visitors were mechanics, thoroughly capable of appreciating the high character of the machinery and processes examined. Much surprise was expressed with the wonderful perfection of the machinery, and object lessons were learned that will be of permanent value to all concerned.

The party was entertained in a princely fashion by the principal officers of the steel companies.

The Horton Chuck Company, of Windsor Locks, Conn., are introducing a new chuck for car-wheel boring and turning machines. They are very busy, and can hardly keep up with their orders.

The Michigan Railway Supply Co., of Detroit, have the contract of supplying the Missouri Car and Foundry Co. 8,000 latest improved Central Steel Brake Beam, for 1,000 Big Four and 1,000 Chesapeake & Ohio.

The Iron Car Company report that their tubular iron cars are meeting with favor with the different railway companies; they have, during the past few weeks, supplied no less than 1,150, and have orders for more on their books.

The Eureka Tempered Copper Company, successors to the Anti-Friction Metal Company, have finished the erection of a fine works at North East, Pa., for the casting of their peculiar metal, which is rapidly making its way into the favor of machinery users.

Mr. Arthur Crandall, long known in Chicago and to the Northwestern trade, as a representative of the Dunham Manufacturing Company, has taken the position of Secretary of same, with headquarters at their Chicago office, rooms 703 to 707 Phœnix Building.

Messrs. Burns, Silver & Co., of Bridgeport, Conn., manufacturers of railway hardware and specialties, have recently introduced a release brake, which wherever tried has proved a success, especially on freight cars equipped with air brakes. They have already a large number of orders for it.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., who have met with unprecedented success in the manufacture of street cars and furnishings, have recently added to their already large factory another building, 50 × 100 feet. They report business as better than ever before.

Mr. Henry B. Denker, vice president St. Charles Car Company, St. Charles, Mo., has been appointed General Manager in place of Mr. T. C. Salveter, resigned, and Mr. A. Rapp has been appointed superintendent. In addition to their regular steam car and car wheel business, they are largely engaged in the building of street and motor cars.

"Nothing too good for our passenger traffic" say the *Chicago & West Michigan*. They are putting on six elegant new coaches, equipped with the Scarritt Furniture Company's seat. It is the same seat that the Chicago & Alton, Big Four and I. & G. N. have so recently ordered for their new cars. The seats are made at the Scarritt Works, St. Louis, Mo.

Currey Manufacturing Company report a large and increasing business with the various railroad companies where fine goods are appreciated. This concern is composed of experienced paint men who may be considered "hustlers" in the best sense of that term. Their factory presents a lively scene, and the long array of mills have all they can do to keep up with their orders. Give them a call.

Messrs. Boaz & Maxwell, of Cincinnati, Ohio, dealers in railway supplies, are the agents for Messrs. Thos. Turton & Sons, Limited, successors of Wm. Greaves & Sons, of Sheffield, England, manufacturers of the celebrated "Greaves" crucible cast spring steel for locomotives, passenger and freight cars; they always keep the standard railroad sizes in stock, and guarantee prompt execution of orders.

Mr. Joseph S. Spinney, of 66½ Pine street, New York, who does a very large business with the railroad companies of South America, has recently shipped 846 cars, 26 Rogers and 35 Baldwin locomotives to the Santa Fé & Northern and Bahia, Blanca & Northwestern Railways of the Argentine Republic. Mr. Spinney has also a number of orders for material for railways in Chili and Peru, etc., etc.

The Springfield Emery Wheel Manufacturing Company, of Springfield, Mass., are the sole manufacturers of the car-box grinding machine invented by Messrs. Stratton & McCullough, of Altoona, Pa., having purchased the right to manufacture under royalty. They have recently opened a branch store at Nos. 18 and 20 West Randolph street, Chicago, Ill., where they will keep a full line of their special grinding machinery.

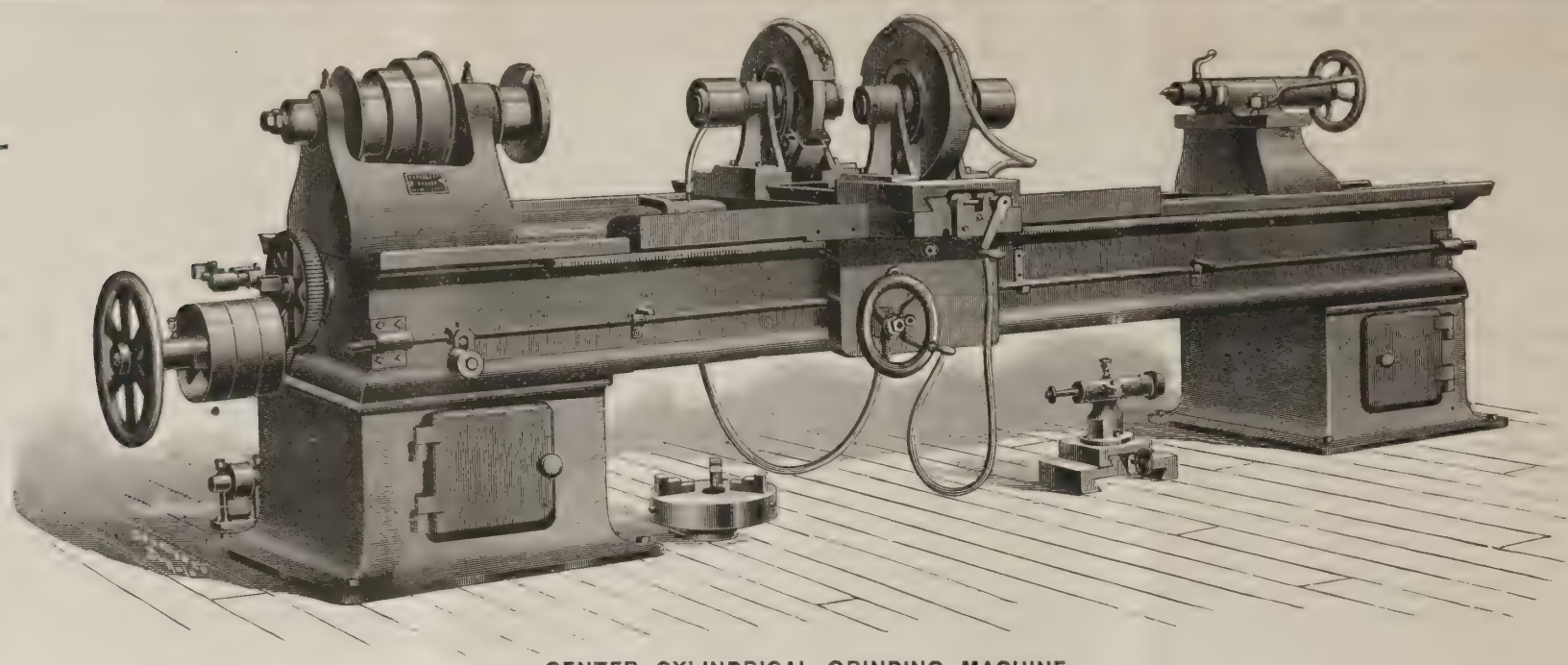
Among the specialties manufactured by the Brussels Tapestry Company, of New York, are window curtains for passenger cars. These curtains were formerly made by Mr. George A. Crisson, of Philadelphia, who is now connected with them. As the Brussels Tapestry Company manufacture the decorative fabrics from which the curtains are made, they are enabled to furnish them at a less price than formerly, and to guarantee the quality of the material.

The Dunham Manufacturing Company, Chicago, Ill., together with the National Hollow Brake Beam Company, will remove April 1 to their new and commodious quarters, 703 to 707 Phœnix Building. This change in location has been made necessary by the rapidly increasing business of these companies, and the new quarters will give them about double the space now occupied at 310 and 311 Phœnix Building, in addition to affording superior light and ventilation.

The National Forge and Iron Company of Chicago write us: Our total consumption of scrap material, which is the only material we use, is 125 tons daily. Net product of finished bar iron per day is over 100 tons. Our forge turns up about 100 axles per day, besides some forgings which we are making for several Chicago houses. We find business very encouraging; have enough orders booked to keep our mill and forge running day and night for next three months.

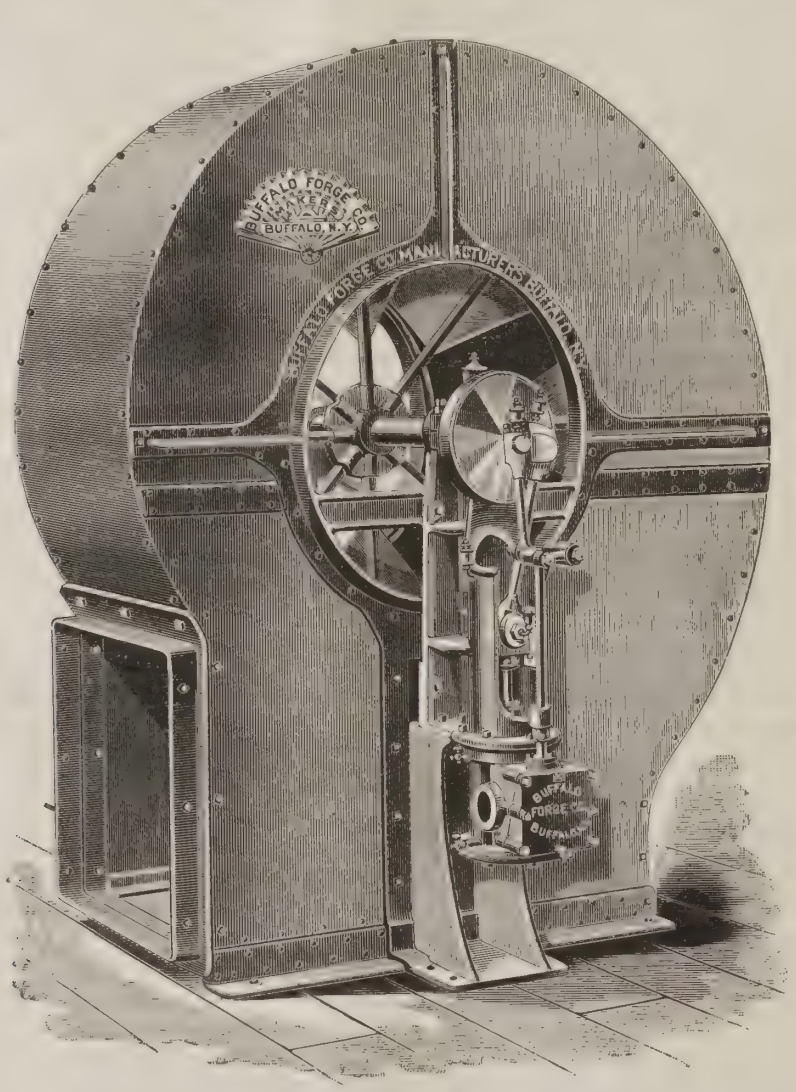
Jenkins Brothers, manufacturers of valves and packing, report business as being unusually good. They make a specialty of valves used on pipe work, and like all specialists of enterprise and ability, have the best facilities for producing cheaply and of high quality. Besides nearly all sorts of pipe valves that are used in connection with pipes, the firm handle pipe hangers, various forms of safety valves, Scotch gauge tubes, and nearly everything used as attachments of steam boilers. The firm has lately published an illustrated catalogue of the goods they handle, which ought to be within reach of all persons using valves and boiler attachments.

The Adams & Westlake Company, Chicago, have entered into the manufacture of brass bedsteads. In making this fact public the company say such bedsteads as have been made in this country have been very poorly constructed and more poorly finished. They soon tarnish and change color, and become loose and rattle in every joint. The American manufacturers seem to have gone at it in their own fashion, disregarding the principles of construction observed in the old country, which have made their goods so much more desirable. The ordinary cheap curtain pole trimmings, such as knobs and rods have been used, and they have given a flimsy and cheap appearance to the bed. The Americans have not understood the art of lacquering as applied to bedsteads, and they have changed their color on this account. We have employed experienced and expert English bedstead makers who have been in the business all their lives, and propose to turn out an article which will be a credit to American industry and enterprise, and which will be sold in competition with the best English makes.



CENTER CYLINDRICAL GRINDING MACHINE.

We illustrate on this page a machine for grinding cylindrical or tapering work, either on centers or when held in a chuck. It is so constructed as to swing heavy work, the bed being supported upon hollow pedestals, forming closets for the reception of small tools and fixtures, and the bed being closed up at the bottom to form a tank or reservoir for holding water which is forced in a stream on to the work by a pump, which is part of the machine. The liberal supply of water prevents heating and expansion of the work, greatly facilitating the grinding, and enabling more accurate work to be done than would otherwise be possible. The carriage carries two emery wheels, and is fed back and forth over the bed by a lead screw, which passes through under its center, and is connected by a split nut, which can be opened and shut the same as on a lathe. The carriage can also be moved by hand, the same as a lathe carriage. The machine is furnished with only one wheel when desired, in which case a steady rest is furnished. An extra head is furnished to run on the carriage, which carries a small wheel for grinding the inside of wheels or other work held in a chuck on the spindle, and such holes can be ground straight or tapering. The feed work and slide of the machine are covered and fully protected from emery and dust. The motion of the carriage is automatically reversed by means of adjustable tappets on a rod in front of the bed. The bed is 12 feet long and work eight feet long, 22 inches diameter can be swung on the centers and over the carriage. Emery wheels from 14 inches to 20 inches can be used. The bearings of the emery wheel spindles are 2 inches in diameter, 4 inches long, the main spindles being 2⅛ inches diameter, with bearings 6 inches and 4⅛ inches long. The machine is built by the Springfield, Glue & Emery Wheel Co., Springfield, Mass.



DIRECT CONNECTED STEAM FAN.

The accompanying illustration shows a new design of direct attached engine just perfected and employed in connection with the Buffalo steam fans, the latest pattern of which also appears.

There is no question but that the direct attached engine affords far superior advantages in fan propulsion, there being no slipping or wearing of belts, the rate of speed being easily increased or diminished as occasion requires, perfect control of the fan as to starting and stopping instantly, and where economy of space is an object but little in excess of the fan itself being required, and this being less than that used with the pulley and belt. In some makes of fans with direct attached engines the engine has been constructed with no space between it and the blower, but where perfectly noiseless action is imperative there should be left some space—not to say, however, that an arrangement like this would fail to meet the requirements at the outset if properly placed, yet in continuous use, it has been proved that the latter is the more satisfactory plan.

This engine is for either high or low pressure steam, and runs with the least possible friction having balanced valves, and is made in sizes ranging from 2 to 50 H. P. high pressure. By reference to the engraving it will be noticed that while doing its work the engine acts as a brace to the blower, the base of which is made of the best angle steel.

The amount of bearing surface also deserves comment, being one of the engine's strong points, considering its compact build. In a 100-inch fan we find the shaft to be 3¼ inches in diameter and the bearings 15¾ inches long. A prominent New York manufacturer, who thoroughly examined the engine a few days since, and speaks with the authority of a connoisseur, conceded it to be the best finished and most compact engine for fan propulsion he ever met with.

In order to be a complete success, a direct fan-propelling engine must possess the qualities of high speed, the ability to run continuously, and oftimes in the midst of considerable dust, without the engineer's attention at any regular time, and these are fully secured in this production. The manufacturers, the Buffalo Forge Company, Buffalo, N. Y., will take pleasure in sending catalogues and answering all inquiries in detail on application.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge of any error that may be noticed in our list.

Baltimore & Ohio Southwestern.—Edward Evans, of Chillicothe, Ohio, has been appointed division master mechanic of the road.

Boston & Maine.—J. A. Farrington has been appointed purchasing agent, to succeed G. F. Hurd, resigned.

Canadian Pacific.—T. A. Mackinnon has been appointed manager of Transportation, with office at Montreal. Thomas Tait has been appointed general superintendent of the Ontario and Atlantic divisions, in place of Mr. Mackinnon.

Central of Georgia.—H. R. Dill has been appointed superintendent, vice L. Hege, resigned. C. F. Thomas has been appointed master mechanic, vice D. M. Guzel, resigned.

Charleston Sumter & Northern.—J. W. Fowler has been appointed general manager, vice W. G. Brownson, resigned.

Chesapeake & Ohio.—W. J. McKee has been promoted to the position of superintendent, vice H. R. Dill, resigned.

Chicago & Eastern Illinois.—George W. Saul has been appointed general manager.

Cincinnati & Muskingum Valley.—C. H. Walton has been appointed superintendent, vice F. G. Darlington, transferred.

Cleveland, Cincinnati, Chicago & St. Louis.—J. M. Barnard has been appointed assistant general manager, with headquarters at Indianapolis. E. A. Peck has been appointed general superintendent. A. G. Wells is appointed superintendent of the Peoria division formed by the absorption of the Ohio, Indiana & Western.

Dover & Statesboro.—Frank W. Scofield has been elected general manager of the Savannah, Dover & Statesboro.

Duluth & Iron Range.—J. L. Greatsinger, has been appointed general superintendent, vice S. T. Pope, resigned. H. G. Bryan has been appointed master mechanic. George C. Kimball has been appointed vice-president and general manager of this road.

Jacksonville, Tampa & Key West.—J. A. Larned, superintendent, has resigned.

Lake Side & Marblehead.—W. M. Harsh has been appointed superintendent of the road, to succeed J. W. Wardwell, resigned.

Louisville Southern.—C. J. Ranahan, of New Albany, Ind., has been appointed master mechanic of the road, with office at Louisville, Ky.

New York, Lake Erie & Western.—W. J. Murphy, general superintendent, has resigned.

New York & New England.—Albert Griggs has been appointed superintendent of motive power, vice J. B. Henney, resigned.

New York, New Haven & Hartford.—Mr. Lucius Tuttle has been appointed general manager, with headquarters at New Haven, Conn.

Norfolk Southern.—G. R. Joughins has been appointed master mechanic in charge of rolling and floating equipment. His office is at Berkley, Va.

Northern Pacific.—Mr. John C. Patterson has been appointed superintendent of the Butte & Gallatin branch.

Pennsylvania Lines West of Pittsburgh.—C. M. Bennett has been appointed superintendent of the western division of the St. Louis & Pittsburgh, in place of Charles Watts, promoted. F. G. Darlington has been appointed superintendent of the eastern division of the Chicago, St. Louis & Pittsburgh Railroad, in place of C. M. Bennett, transferred.

Pennsylvania, Poughkeepsie & Boston.—Henry H. Kingston has been apointed general manager; C. Stanton resigned. Mr. George Gage has been appointed master mechanic.

Peoria, Decatur & Evansville.—R. B. Starbuck has been appointed superintendent.

Philadelphia & Reading.—M. F. Bonzano, appointed assistant general superintendent. G. D. Whitcomb appointed superintendent to succeed M. F. Bonzano, promoted.

Pittsburgh & Lake Erie.—Elliot Holbrook, general superintendent, has resigned.

St. Louis, Arkansas & Texas.—W. T. Smetten, has been appointed division superintendent, with office at Pine Bluff, Ark.. to succeed T. W. Kennon, resigned.

St. Louis & San Francisco.—E. P. Vining has been appointed assistant general manager.

Union Pacific.—Robert Baxter, assistant superintendent of the Wyoming Division, with office at Cheyenne, has been appointed superintendent, to succeed W. L. Rider, who has been appointed superintendent of the Idaho Division, with office at Pocatello. F. L. Corwin has been appointed assistant superintendent of the Wyoming Division, with headquarters at Green River.

Valley.—C. J. Johns has resigned, and the office of master mechanic has been abolished.

NATIONAL CAR AND LOCOMOTIVE BUILDER

MAY, 1890.

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The Iron Car Co. have ordered 1,000 cars built.

The Union Pacific are said to be in the market for 3,000 cars.

The New York & New England are in the market for 500 cars.

The Vermont Central are said to be in the market for 1,000 cars.

The Beech Creek Company have contracted for 500 30-ton hopper cars.

The Fall Brook Company is said to be in the market for 400 freight cars.

The Cincinnati, Hamilton & Dayton are in the market for five locomotives.

The Gulf & Chicago will, it is stated, soon order five 40-ton locomotives.

The Easton Car Heater Co. are having 50 cars built at the Harrisburg Car Works.

The San Francisco & North Pacific will soon place an order for three locomotives.

The Chicago, Burlington & Quincy will soon award a contract for building 18 locomotives.

The Seattle, Lake Shore & Eastern has recently let contracts for four heavy locomotives.

The Canada Cattle Co. have ordered 1,000 cars from the Ensign Manufacturing Co., Huntington.

The Louisville, New Orleans & Texas will shortly place orders for 15 locomotives with Eastern builders.

The Rogers Locomotive Works have recently delivered a heavy engine to the Kansas City, Watkins & Gulf.

The Richmond & Danville and the Hocking Valley Companies have each ordered 1,000 freight cars lately.

The Chesapeake & Ohio Railroad Company have begun the erection of machine shops at St. Albans, W. Va.

The Georgia Southern are having ten locomotives built at Rhode Island and are in the market for six coaches.

The New York Central have contracted for 3,000 freight cars and are building a like number in their own shops.

The Wheeling & Lake Erie has placed an order for 17 new locomotives with the Pittsburgh Locomotive Works.

The Brooks Locomotive Works, of Dunkirk, N. Y., are building 25 engines for the Lake Shore & Michigan Southern.

The Columbus, Shawnee & Hocking Valley has awarded the contract for the construction of six 47-ton freight locomotives.

The Atlanta & West Point are refitting their officers' coach "Alabama" in first-class style, and putting in the Frost system of lighting.

The Chattanooga Union have ordered 12 passenger cars, six of them to be of the elevated railroad pattern and six of them ordinary coaches.

The Pacific Short Line have ordered 400 freight cars from the St. Charles Car Works, and are in the market for some passenger cars and locomotives.

It is reported as we go to press that the Union Pacific have contracted for seventy locomotives from the Rhode Island Works and sixty-one from Baldwin's.

The Boston & Maine are said to be in the market for 1,000 cars. The company have recently ordered 100 Boies steel-tired wheels to be used under passenger cars.

The Old Colony road has purchased from the Mason Machine Company, Taunton, Mass., a bogie engine, built for the Atlantic & Ohio road about four years ago, and which was never delivered.

The Central of Georgia is to receive soon from the Dickson Locomotive Works, Scranton, Pa., the first lot of an order for 40 passenger, freight and switching engines. The order is to be completed by July 1.

The car-axle department of the Anniston, Ala., Rolling Stock Works, has orders booked for 16,000 axles, and in order to supply this demand the present capacity of 120 axles per day is to be doubled as soon as the necessary arrangements can be perfected.

The Union Pacific and Northwestern through line have just received 400 new freight cars bearing the double-header name. They are said to be the strongest and finest traffic cars ever built, having a capacity of 50,000 lbs., and equipped with air brakes.

The South Carolina Company are in the market for 12 coaches. The specifications call for a smoking room in the end of each car capable of accommodating 12 persons. The cars will be first-class in every particular and will be equipped with the Frost lighting system.

The Savannah, Florida & Western are building 60 cars a month in their own shops. They did that amount of work all last year. Parties who have examined the cars and are competent to judge say the cars are as fine in materia and workmanship as anything they have ever seen.

The Steel Tubular Car Company, of Bradford, Pa., has bought 3,000 acres of land in Tuna Valley, between Bradford and the New York State line, and the erection of shops will be begun as soon as possible. The company will build fire-proof, indestructible, steel tubular cars.

The Basic City Car Works Company, with a capital stock of $5,000, with the privilege to increase same, have been organized. W. S. Gooch, of Roanoke, is president; James Bumgardner, of Staunton, vice-president, and M. A. Booker, of the same place, secretary and treasurer.

The Lehigh Valley has recently completed a new passenger engine at its Hazleton shops, from designs by David Clark, master mechanic. The locomotive has 20 × 24-inch. cylinders and 5-foot 8-inch drivers. It weighs 107,072 pounds. The weight on the drivers is 76,832 pounds; and on trucks 30,240 pounds.

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The Cleveland, Cincinnati, Chicago & St. Louis has placed an order for 10 large passenger engines, to be delivered in May and June. These engines will have 18 × 24-inch cylinders, 5½ foot driving wheels, three pairs of drivers and a 56-inch wagon-top boiler. The fire-box will be 106 inches long by 42 inches wide.

The Atlanta Car Company has been organized at Atlanta, Ga. The following officers have been elected: J. C. Peck, president and general manager, and J. G. Healey, secretary and treasurer. The company will buy a full line of wood and iron machinery for the manufacture of freight cars. Ground is now being graded and plans drawn for buildings.

The Baltimore & Ohio Railroad in a few days will begin to put in a track tank on the Washington and Philadelphia division. This will enable the engines to make faster time, as the engines can then take water while running at a good rate of speed. The officials say they expect to equip this division with some of the finest passenger coaches in use, the construction of which is now going on at the Pullman Car Company's shops.

The Northern Pacific Railway Company will receive bids at its head office in St. Paul, Minn., for the construction at the head of the bay, Tacoma, commencing this summer, of car shops and round houses, involving with their equipment an estimated expenditure of $835,000. The bids will be opened in May or June. Several large St. Paul contractors are now in Tacoma to look over the situation with a view of putting in bids.

The Baldwin Locomotive Works are building four locomotives for the Birmingham, Sheffield & Tennessee River road for delivery in May and June, 48 locomotives for the Denver & Rio Grande, and 10 for the New York, Pennsylvania & Ohio. These works have lately delivered three 10-wheel engines to the Cairo Short line, six consolidations for the Baltimore & Ohio, and a number of small engines for the Redendo Beach road.

Philadelphia and New York capitalists have organized the Steel Tubular Car Company, which intend building a town near Bradford, McKean County, Pa., to exceed in importance, it is said, the town of Pullman, near Chicago. The company are interested in an invention that is expected to revolutionize the present construction of passenger cars, and have bought from 3,000 to 5,000 acres of land near Bradford, where the car works are to be established. The invention provides for a framework of steel tubing, so arranged as to withstand the severest shocks or collisions, or derailment.

The New York Central & Hudson River road has recently let contracts for building 125 locomotives, the delivery to begin in June and to be completed by Sept. 30. The order includes fifty 19 × 26 mogul freight engines, let to the Rogers Locomotive Works, Paterson, N. J.; 75 locomotives to the Schenectady Locomotive works, of Schenectady, N. Y., including 21 eight-wheel passenger engines with 19 × 24 cylinders, 25 mogul freight engines with 19 × 26 cylinders, and 29 eight-wheel switching engines with 18 × 24 cylinders. All the freight and passenger engines will be equipped with the American steam driver brake.

In the South in railway managements one can find much that is interesting from the fact that practices are so different from other sections of the country. The South Carolina Railroad recently changed managements, dethroning a regime of some 20 or 30 years' standing. Scrap had been allowed to accumulate from year to year until there was scarcely room for new materials. Old tools were used, because too poor to buy new. A wooden framed wheel press without gauge had been used for years, and everything of the most primitive character was used. The new management, under C. M. Ward, as general manager, and J. H. Agnew, as superintendent of motive power, virtually resurrected everything; $16,000 worth of scrap was at once sold, $10,000 of it invested in new tools; $5,000 worth more has since been sold. Engineers are put on the mileage basis. New engines and cars have been ordered, and everything is being put upon a business basis.

At the April meeting of the Northwestern Railroad Club Mr. Hughes, of the Fox Solid Pressed Steel Company, exhibited blue plates of several car center plates which have been adopted as standards by different roads. These center plates, he said, vary in weight from 54 to 115 pounds per car, according to the taste of the company using them. The 54-pound plates were, in his opinion, entirely adequate for all purposes. Every plate was tested up to 200,000 pounds pressure, and they had never failed to give satisfaction. The cast-iron center plates which these replaced varied from 250 to 350 pounds, effecting a saving in dead weight by the use of the steel plates of from 200 to 300 pounds per car. Mr. Hughes also showed blue prints of cylinder head casings which have an advantage in weight as compared with the ordinary cast-iron casings of 36 per cent., and of front end and doors of which weigh also about one-third as much as the ordinary now in use. In price, Mr. Hughes said in answer to a question, the steel parts come about the same as cast iron, and have, of course, a large advantage over malleable. He claimed that the steel, which in the center plates is ⅝ inch, and in the front ends also ⅝, with ¼ doors, was practically indestructible.

The Brooks Locomotive Works, of Dunkirk, N. Y., have recently shipped 73 locomotives to various roads. This number includes the following orders: Twenty 19 × 24 ten-wheel and ten 18 × 24 six-wheel switching, to the Cleveland, Cincinnati, Chicago and St. Louis; ten 19 × 24 ten-wheel, two 18 × 24 six-wheel switching, and five 18 × 24 passenger, to the Baltimore & Ohio Southwestern; two 18 × 24 six-wheel switching to the Chicago, Rock Island & Pacific; ten 18 × 24 passenger, to the Chicago & Grand Trunk; ten 18 × 24 moguls, to the New York, Chicago & St. Louis, and three 15 × 20 moguls, to the Au Sable & Northwestern, and a heavy passenger engine, the first of an order, for the Vanegas, Cedral & Rio Verde, of Mexico. Among the engines that the firm is now building are the following: Ten 18 × 24 heavy ten-wheel passenger engines for the Cleveland, Cincinnati, Chicago & St. Louis; ten 18 × 24 heavy ten-wheel passenger for the Wisconsin Central; twenty-five 17 × 24 ten-wheel freight for the Lake Shore & Michigan Southern; twenty-five 19 × 26 heavy mogul freight for the New York Central & Hudson River road, and fifteen 18 × 24 six-wheeled switching for the Illinois Central. The works are now turning out four and five locomotives per week. When the new hydraulic plant is completed, and the new machinery now being received is put in position and in full working order, a locomotive of the heaviest type can be turned out complete every working day.

The reason that black walnut always maintains its supremacy, or, at least, its rank as one of the most desirable woods for furniture making and inside finishing, is, that in proportion to its heft its hardness is greater than any timber in use. The relative hardness of the different kinds of lumber is calculated from hickory, which is the toughest and hardest of any in general use; and calculating that at 100, black walnut stays only at 65, while the weight of green black walnut lumber is as 90 to 100 compared to hickory. It will thus be observed that while it approaches hickory in weight, it is much softer and easier to work. This advantage would serve to maintain its popularity, to say nothing of its superiority of appearance

EDITORIAL CORRESPONDENCE.

Notes of Travel.

IN CHICAGO.

Early last month found me speeding westward on a pilgrimage to St. Paul. The first stopping off point was Chicago, and we had a curious intimation that we were approaching a far extended city before we saw the lights of Chicago. The municipal authorities of that city, who are always struggling for extension of territory, have pushed the city limits far out into the prairies. According to a city ordinance, trains were required to be run within the city limits at a speed not exceeding ten miles an hour. For years it was customary to ignore the ordinance and run at moderate speeds, but the courts having held the companies liable under the ordinance for damages when persons were killed or injured, the different railroad companies agreed together to obey this rule calling for a speed of ten miles an hour until it was repealed. When I was going to Chicago the agreement was in force, and the train crawled along at ten miles an hour for about 15 miles. The railroad company had accelerated the speed of the train on the preceding part of the journey to land it in Chicago on schedule time, but the passengers were very impatient when the slow moving took place. They growled and complained as much as if they were certain to arrive too late for making connections or meeting their friends. American travelers do not enjoy slow running, no matter what rule brings it about.

The most striking thing I found in Chicago was the excitement prevailing because the city had procured the World's Fair. In the few days spent in Chicago I heard more talk about the Fair than I heard in New York during the months our business men were supposed to be working to secure the Fair. It appeared to afford my Chicago friends great enjoyment to twit me about New York failing to secure the Fair. I do not remember that any one failed to remind me of the disappointment they supposed New Yorkers were suffering from. It was the first I had learned about the disappointment, for I had seen no traces of it among New York business men.

AT THE ILLINOIS CENTRAL SHOPS.

The Illinois Central Railroad Company have for years been noted for the slow progress made in adopting the improvements considered necessary by other Western roads. The officers appeared to be proud of the company's ancient history, and were solicitous to keep everything in the condition that would remind the public that the road was one of the oldest in the West. A change of heart seems to have happened lately, and the management has become progressive. There is nothing likely to improve the property and the methods of doing business which the management is not ready to adopt. Arrangements are being made to ballast the main line with broken rock, great increase of siding facilities are contemplated, the road will be improved in many ways, station signals will be introduced, and many ancient members of the rolling stock family that ought to have graced the scrap heap years ago will be retired from the public gaze.

During a visit to the machine shops I found Mr. Henry Schlacks full of business connected with the improving of the rolling stock under his charge. He is receiving from the Brooks Locomotive Works 20 ten-wheel locomotives with cylinders 19 × 24 inches and boilers 58 inches in diameter. These engines are equipped with all modern improvements. They will displace from heavy freight service about twenty-five smaller engines, and do the work at a saving of about 33 per cent. The company have also ordered a number of six-wheel switching engines with cylinders 18 × 24 inches. The boilers are of Otis steel throughout, ½-inch thick for shell, and are required to carry safely a working pressure of 160 pounds. The engine weighs 86,000 pounds in working order. Among the details are Richardson balanced valves, solid piston heads fitted with cast-iron packing rings, Laird crossheads, consolidation safety valve and Ashton blow back valve, sight feed lubricators, Monitor injectors, American driver brake operated by Westinghouse automatic air, solid ended side rods and Krupp crucible cast steel tires. Similar equipment is applied to the ten-wheel engines.

They are making important additions to the car equipment. Among recent orders are 20 standard day coaches, 20 suburban coaches, all with 42-inch wheels and the M. C. B. axle for heavy cars. More detailed particulars of these coaches will be found on another page. As additions to the freight rolling stock they are getting 400 25-ton box cars, 150 30-ton coal cars and 155 25-ton refrigerator cars, all 35 feet long, with cast-iron wheels 36 inches diameter and the M. C. B. axle and channel-bar truck and American continuous drawbar. They have also contracted for 100 furniture cars 40 feet long. They are equipping 200 fruit cars with air brakes, and expect to put this improvement on many more freight cars in the near future.

The Illinois Central company are very strict about the quality of cast-iron wheels used, and in consequence they have been very fortunate in escaping from the prevailing damage caused by broken wheels. On the whole system the damage caused by broken wheels last year was less than $60. Another particular they are fortunate in is absence of hot boxes. They use their own design of box and bearing, which is superior in many respects to the M. C. B. standard. It may be safely asserted that no railroad in the country is so free from hot boxes on passenger trains.

In the engine shops they are very busy mostly with repair work. There has been a rearrangement of the tools since I was last in the shop, which increases the convenience, but they are still badly in want of enlarged shops. In addition to the repair work they have on hand the building of four suburban engines of the ordinary type, with cylinders 16×24 inches, and drivers 56½ inches diameter.

NATIONAL HOLLOW BRAKE BEAM WORKS.

In the south part of the city, near the Chicago, Rock Island & Pacific shops, I happened upon works lately built by the National Hollow Brake Beam Company for the manufacture of their specialty that are well worth a visit. They enjoy the advantage of having been designed for a particular purpose, and all conveniences that could be devised have been provided for facilitating production. The demand for iron brake beams is already very great, and is increasing at a rapid rate, but it will increase enormously before the productive capacity of this establishment becomes overtaxed. The movements in brake beam making go on like the action of an automatic machine. Two-inch lap welded tubes cut to lengths, wrought-iron rods, and the malleable castings that make up the attachments enter at one end of the building, and in a remarkably short time emerge on the other side complete hollow brake beams, tested to withstand a strain of 14,000 pounds, without more than ⅛ inch deflection. Every operation is done by a machine specially designed for the purpose, or on common presses with peculiar cutting or bending attachments. The tube is first put into a sort of double-headed punch, where the slots at each end for securing the head are cut out simultaneously. Then another punch cuts and depresses a tongue-like opening, through which the truss-rod passes. From there the tube goes to the fitting bench, where the other attachments have been going as they pass through the machines that make them ready for putting together. The last operation is the pressure put on by the testing machine. That apparatus records the exact deflection. If it is too great, which rarely happens, the beam is put aside and rejected. All the parts of any particular kind of beam are interchangeable.

The diversity of railroad men's judgment is very strikingly illustrated in the iron brake beams under construction in this establishment. There is already a confusing diversity in the form of heads called for, and several companies have specified very complicated forms to make the head used on wooden beams interchange with the iron beam. It would be a much better plan to face the inevitable and agree upon a head adapted to an iron beam.

They are putting up special machinery in this shop for the manufacture of the Westinghouse iron brake beam.

CHICAGO AND NORTHWESTERN SHOPS.

While visiting Mr. Whitman, general manager of the Chicago & Northwestern, I learned that they were about to equip several thousands of freight cars with air brakes, and in other ways keep up with the most advanced practice in railroad operating. During this visit I was struck with the fact that nearly all railroad managers visited in the West were full of progressive enterprises that their companies were interested in. On the other hand, when I call on Eastern railroad managers, they are disposed to assert that the limit of improvement has been reached by them, although they are invariably behind Western roads in most respects. The tide of Empire has gone Westward and missed a great part of the slumbering East.

In the locomotive shops I found that merely repairs were going on, but they seem to have plenty of that work on hand. They have stopped indulging in the expensive luxury of building their own locomotives, and I found that those most interested were very well satisfied with contract building. They are slowly but surely stocking the road with ten-wheel locomotives for freight service, and expect gradually to make this the standard engine for that kind of train.

In the car shops I found Mr. Schroyer unusually busy and full of plans for the improvement of his department. They were finishing a new officers' car and a new car to be used as a school of instruction for trainmen in the use of the Westinghouse air brake. The latter car is equipped with all the appliances necessary to make the working of the air brake readily understood.

Some new milk cars have lately been finished in the shops that have valuable peculiarities, The cars are air tight and have ice storage tanks for keeping the temperature low. As most milk cars get to smell badly from the spilt milk passing beneath the floor, where it cannot be washed out, these cars are provided with an under floor which can be washed out by water from a hose.

A convenient improvement lately introduced into these shops is a system of air pipes and engineers' valves placed at various points to enable inspectors to test the air brakes of cars that have been undergoing repairs. They have also water and steam pipes in the yards, and by means of a washing out injector they heat and propel water used in washing cars.

All round the paint shops there are boards for recording the daily work put upon cars, which are said to be of great convenience to the foremen. They are finishing many of their cars with one coat of rough stuff, and find that it produces a good, serviceable job.

An admirable system of keeping the mileage of steel tired wheels has lately been introduced here. Everything that happens to a steel tired wheel from the day it goes into service until it is worn out is recorded in the book, including the various turnings and the quantity of metal removed. The inspectors have blanks with the engraving of a wheel upon them for reporting accidents to wheels. When anything goes wrong with a wheel the inspector reports it and sketches the particulars on the picture.

This company has in use a very simple form of air brake piston indicator invented by Mr. Schroyer and Mr. E. B Thomson, chief draughtsman.

A large number of the ore cars used by this company are equipped with the Janney coupler. The breakages of couplers are reported and described graphically by means of an engraving the same as with steel tired wheels. The breakage of couplers thus far has not been anything to complain of.

SMOKE PREVENTION IN CHICAGO.

The municipal authorities of Chicago make periodical revivals of agitation calling for the prevention of smoke, and locomotives come in for their share of attention. Owing to the excitement kept up against smoke, several railroad companies are using coke for fuel in their switching and suburban engines. The Wisconsin Central has escaped annoyance by training their engineers to keep down the smoke, and their suburban engines are a good example for other roads. I happened to have the opportunity to watch the locomotives belonging to the various railroads, and the difference in the smoking was astonishing. The locomotives themselves give an object lesson to the city authorities which incites them to prosecute the smoke raisers. General Manager Allen, of the Chicago & Great Western, as the Wisconsin Central terminals are called, deserves credit for the cleanly condition of his suburban trains.

They have in use here a double-header locomotive for suburban traffic of a type that many railroads could adopt at small expense. It is merely an old eight-wheel engine with the frames lengthened out behind to make a small tender, which is carried by a four-wheel swing center truck. The engine was altered by Mr. John Player, master mechanic at Waukesha, for about $500, and the engine is as good and does as efficient work as any of the double-headed suburban engines that were specially designed for the service.

AT ST. PAUL.

After making a brief stay at Waukesha, where the Wisconsin Central have the model engine shops of the West, I went to St. Paul and had for a few days the pleasure of dwelling on the wonderful growth of the twin cities.

I was in time to attend a well-represented meeting of the Northwestern Railroad Club. This club is well supported by the railroad men in the district giving their personal attendance, but it would be in a more healthy condition if the members not nearly all go there to listen. In club meetings it is a necessity to success that the members should be willing to give as well as to receive.

An interesting place to visit in St. Paul is the office of Mr. W. T. Small, superintendent of motive power of the Northern Pacific. He has a museum of broken articles that give very edifying information about certain material. Some of the specimens give eloquent though silent advice of things not to purchase. The board or case in Mr. Small's office, which is used to locate the distribution, type, age and condition or previous servitude of locomotives, has been so often written up that I exercise great self-denial in refraining from describing it again. I may say, however, that it is by far the best I have ever seen, and is thoroughly worthy of imitation.

The Northern Pacific have a considerable number of cars running with axles that have collarless journals, and I was much interested learning from Mr. Small that these journals break more frequently than those having collars. There is a tendency of the brass to cut a sharp corner at the inside fillet of the journal, and this leads to breakage.

While in St. Paul I met Mr. W. A. Scott, general manager of the Chicago, St. Paul, Minneapolis & Omaha, and learned from him some particulars of his experience in running flangeless wheels in the middle of six-wheel trucks. He introduced this practice when he was assistant superintendent of motive power of the Chicago & Northwestern, and designed an axle-box suitable for controlling wheels that have no flange. The combination is working very satisfactorily, and the company are by this means able to get a long mileage out of wheels that otherwise would be scrapped owing to sharp flanges.

GREAT NORTHERN SHOPS.

The first shops visited were those belonging to the Great Northern, which is the new and unfamiliar name of the St. Paul, Minneapolis & Manitoba. I went accompanied by Messrs. Small and Player, and was happy in anticipation of the information they would help me to draw out of Mr. Pattee, the master mechanic. We found that he was not the least proud over the change of name, but led us recklessly through the rain and mud just as if his road was no greater than his neighbors. It was not a good day for collecting information, as the weather happened to claim too much attention, so my well laid schemes for a corner on facts about Northwestern railroad matters miscarried.

The rolling stock of the road looks better than it did when I was last in the shops. The railroad system is hard to operate. The feed water is extremely bad, and makes the call for boiler repairs excessive. The alkaline sand and

dust of summer and the low temperature of winter are hard on all the rolling stock, so that keeping the equipment in decent order is no sinecure.

Mr. Pattee devotes great attention to the cleansing of boilers, every facility being provided to wash out mud and to prevent the accumulation of scale. This practice has enabled him to reduce the need for boiler repairs. The engineering department of the road are also giving valuable aid in reducing the cost of repairs by selecting for boiler purposes the best water to be found.

They are experimenting here with a combined extension smoke box and spark arrester which consists of a cast iron front with a box at the lower end for holding the sparks. It is said to give satisfaction and provides all the advantages of an extension front with much less material.

My observations of these shops for years past was that great confusion and accumulation of material existed about them, due no doubt to some extent to overpressure of work There seems to be a decided improvement in this respect under Mr. Pattee's management. Work in the different departments appears to go on in a very orderly fashion, but there were very few things of an unusual character that supply points to write about.

ST. PAUL & DULUTH SHOPS.

It is hard to find anywhere more conveniently arranged or better managed shops than those belonging to the St. Paul & Duluth at Gladstone, about eight miles from St. Paul. The shops were arranged and built under the immediate supervision of Mr. C. F. Ward, Master Mechanic of the road, and he has imparted a great deal of his individuality to the place, which manifests itself in plans for performing work with the least possible amount of superfluous labor. The car and machine shops are two parallel buildings with a transfer table between them which serves both shops. A turn-table placed outside the end of the transfer pit enables a switch engine to operate the transfer table. The paint shop, planing mill, blacksmith shop and other adjuncts of the erecting shops are very conveniently placed.

We found some Rome engines in the shop that look very well, but are said to have a very bad reputation. They were said to be out of the correct stroke. Mr. Ward is putting 4-inch Latrobe tires on some engines that have too much cylinder power for the weight on drivers. He has an unusual way of fitting up driving boxes. A rough cut is first taken off the box, then it is bored and the brass of the half-round kind pressed in. The collar is then fitted in and afterward a finishing cut is taken off the box, ensuring accuracy. This overcomes the distortion caused by pressing in the brass and makes a highly durable and easy working box. A peculiar arrangement of packing the piston glands is followed here. A spring is put into the inside of the stuffing box, as in some forms of metallic packing, which pushes the packing outward. The gland is made to go close up to the back cylinder casting and cannot be screwed up. Soapstone and similar packing is used in this way, and the only pressure that can be put upon it is that given by the spring and steam. As there is no opportunity to screw up the glands unevenly, the piston rods receive no damage. All the pistons have a brass plug secured in the head to make a thread for the follower bolt. That prevents the breaking of follower bolts and is said to more than pay for the extra first cost.

There is rather a neat arrangement for transmitting power from the engine at different speeds in use here. The shop engine is so located that the belt for the machine-shop shafting is stretched in one direction and that for the wood-working machinery directly opposite. The iron machinery shafting had to be run about 120 revolutions per minute, and the shafting for the wood-working plant nearly double that. The engine is run about 80 revolutions per minute, and the speed for the shafting of the two departments is regulated by the size of pulleys used, the pull of one belt counterbalancing the pull of the other.

They have a remarkably neat, well arranged and well kept planing mill, which is equipped mostly with Berry & Orton machinery, which is highly spoken of. The mill is kept clean by an exhaust fan and shaving carriers that are kept in working order. It is surprising how many shops there are where one finds the cleaning machinery chronically out of order. This condition of things always suggests to my mind that the foreman in charge is incompetent. This and all the other shops are well lighted through the sides and through the monitor roof of the buildings.

There is a separate shop for wheel and axle work. Here they have the best kind of machinery for doing the work, and it has every appearance of being well and cheaply done. They have a Niles lathe for wheels that takes hold of the journal. They run this tool for all it is worth, and it slices remarkably heavy cuts off worn ties. Among home-made contrivances that I noted were an attachment put on a grindstone arbor for cutting the fillets of car brasses; a peculiar form of band saw used by the pattern-maker, and a hair-cleaning machine for helping the upholsterer.

They have got an excellent tool room well supplied with small tools and instruments of precision and everything about as neat as a jeweler's show case. I made a raid on Mr. Ward, accompanied by Messrs. Small, Player & Fraser, and we all felt like giving a vote of thanks for the pleasant visit.

When I was at the station of the Minneapolis & St. Louis on my way South, I was recognized by Mr. W. C. Hays, a most intelligent engineer belonging to the road, who invited me to a seat on the engine, which was gladly accepted. While on the engine I had the opportunity of finding out that Mr. Hays, who is an interested reader of this journal, is remarkably well posted on everything pertaining to the operating of locomotives. He is a representative man of the new order of locomotive engineers. His particular pride is in what he knows about his duties, not about having the right by seniority to claim certain privileges. I was pleased to find that this engineer, whose work was evidently a labor of love, expressed himself as being indebted to the NATIONAL CAR AND LOCOMOTIVE BUILDER for help in his quest for engineering knowledge. A. S.

Journal Bearings and Driving-Boxes.

At the April meeting of the Northwestern Railroad Club the above subject was called up for discussion.

Mr. J. S. Leslie exhibited a journal bearing which is in use under the rotary snow shovels. The bearing is so designed that the impact can yield in every direction without disturbing the part that presses upon the journal. It has given wonderfully good results under the heavy service of carrying the heavy snow machines.

Mr. T. A. Fraser described a bearing that he is using in engine trucks. The brass fits into the shell of the engine truck, and instead of having a solid bearing, has two strips of Babbitt about an inch apart in the center, and those strips of Babbitt extend below the shell of the box and the brass about $\frac{3}{16}$ of an inch. Have to use good, strong Babbitt. That is about the only peculiarity there is about it. Had an engine in the shops which had run from a year ago last March until last October, and it was not worn down to the brass. The Babbitt had worn down possibly, and there were still two journal bearings that were as good as new.

Mr. S. Davis: I notice in the report in the *Northwestern Railroader*, that the majority of the master mechanics advocate the semi-circular brass. Now, the semi-circular brass is all right provided you get it fitted into the box in a right manner I can go into any one of your machine shops, take a plane and plane off your brass, and I can put the brass in, and fix it all up, and when you see it on the engine, you say, "Well, now, that man made a good job of that." At the some time, it is no job at all, if you only know it. And there comes the whole secret of these hot boxes to a great extent. Now, the right way, or the way that I consider the right way, to fix a driving box brass in after you have got the right composition of metal (which I believe to be six parts of copper to one of tin; many people put a little antimony in or a little zinc; if you put zinc in it takes away the hardness of the metal) is this: if that brass is turned up, say one sixty-fourth of an inch larger than the box, while it is perfectly straight, and the box is slotted; and the mechanic goes to work, and when he examines it he says, "Well, it goes pretty tight; too much pressure." He will spring the box open, and that will ease it on the side, and the consequence is that when you get the brass in you get all the pressure on a certain part of the brass and on the lips of the brass. It is off on the side, though so little off that you cannot notice it. The consequence is that just as soon as the box wears, it begins to get more and more loose, and the consequence is, it plays out. Then again the semi-circular brass has many disadvantages, because it is difficult to line up. I advocate that the cheapest and the best kind of driving box brass is in three pieces. I have no doubt that you gentlemen have seen what Mr. Fraser used. Put three pieces in, two side pieces and a center piece. If you get an engine in the house, and you want to lift it up, and you want it done quickly, it is a very easy thing to knock those pieces out, refit them in and file the key off a little, and fix the whole thing up again. For that reason I believe that the sectional brass is best. Then, on the other hand, I believe that there is a box which is used on a great many railroads in this country (it is used on the Baltimore & Ohio road for one, I know) and that is the solid brass box, got up in good shape, that will outwear all other boxes. The question arises, what are you going to do with it when it gets too large for your journal? You can't close that. No, but you can send it to a brass foundry, and have it molded again, and so it becomes a new box. The lateral motion is taken up in that way. A great many driving boxes will break when they become hot. If you notice, they will always break straight across where the plug is, and that is what I always claim is radically wrong, to spring the box open to get the brass in, because it makes a strain on the metal just there, which is the weakest part of the box, and then drive the plug in, which is probably done with a pretty good-sized hammer. There is a spring on the box, and just as soon as a sudden jar comes, why, there is where it breaks. Notice the ease with which a sectional brass is repaired, and the ease with which it is got at. That is why I believe that a brass of that kind is the best. I have seen engines run where the composition of the brass on the right side has been of six parts of copper and one part of tin, and those on the other side zinc and copper; and where the composition has been made of tin and copper it has always given the very best results, and they have been less liable to hot boxes.

Mr. Angus Sinclair, having been called upon by the president to give his views on this subject, said:

"I have taken considerable interest in the driving-box bearings and the different forms of boxes and forms of bearings, and I must confess that our friend who last spoke displayed himself particularly familiar with the subject. A year ago I was very much in his way of thinking about the circular brass. When it was discussed at the Master Mechanics' Association meeting last year all my sympathies were in favor of the hexagon brass or the solid box. However, since that time I have been devoting particular attention to what I could see in the shops when I have been going around, and I am not so strongly impressed with the advisability of changing to solid boxes or abandoning the circular brass as I was. I admit the objections which the last speaker raised to the pressing in of the circular brass; but there is good fitting and bad fitting, and where that work is done very well—is done in a thoroughly workmanlike manner—I find that the objection to it is not great. We all know that now and again a box will run hot, but hot driving boxes are by no means the rule; and I fancy that when a box displays an imperfection in that way, there has been inferior fitting put upon it; and, inasmuch as about seventy-five per cent. of the boxes in this country are still using half-round brasses, I imagine that it is a case of the survival of the fittest. The people have been using the boxes long enough to know what will give the greatest satisfaction, what will display the greatest durability, and give the most wear for a given expense. Durability is of greater importance than first cost, and if the hexagon brass had displayed the merits claimed for it over the circular brass, I fancy it would have forced its way to the front before now. I find, however, that a good many who went in for the hexagon brass have returned to the circular brass. On questioning them as to the cause of making the change, I found that they all said they could see no advantage in the hexagon brass; it was more difficult to fit, there was greater work put upon it in the first place, and then it did not seem to do any better, and in many cases it did worse than the circular brass. In finishing and in tooling there is always an advantage in having a circular surface, and it gives a great advantage in fitting. Consequently, I fancy that with all its faults, the circular brass is about the best we have. That is my conclusion against my prejudices. I was prejudiced in favor of other forms at the time of the convention, prejudiced in favor of solid brass boxes, and have been looking very much into that ever since. Wherever I knew that they were using solid brass boxes, I have made it my business to go and find out how they did.

You all know that brass expands considerably more than cast iron; and I have found wherever I went, with the exception of on the elevated railroads of New York (where the boxes are very small), that there was more or less trouble with stuck wedges and with the heating of the box where the brass box is used. Last month I was on a Southern tour and I found that the Cincinnati Southern were using a brass driving box to great advantage. They seem to be perfectly satisfied with it, and they appear to have escaped the general trouble. But to do that, they have got to be very careful in the setting up of wedges, and give the box a chance to expand as far as it will without sticking. The New York Central, in some very large engines they have built lately, have used brass driving boxes for them—very heavy driving boxes; they weigh 500 pounds each finished, and they expect to get good service from them, but, of course, it is to a great extent experimental. I fancy, however, that it is a question whether they will develop anything specially meritorious over the cast-iron boxes. With all its faults the cast-iron box is an admirable device; it breaks very rarely, it is cheap to make, and it runs very well. There have been many mistakes with cast-iron boxes since engines were enlarged, by putting too little stock in the boxes for the size of the engines. There has been a great tendency in many quarters to make a small box fit a large journal. They would increase the size of the engine and increase the frame, and make very little increase in the size of the box; and I attribute a great deal of the troubles from broken cast-iron boxes to bad proportions. Some of my friends are using steel boxes satisfactorily. I think that those who have failed with steel have not taken care to keep them from heating by rubbing on the hub. Where steel is run successfully, they put a brass gib between the box and the hub. In some instances they bore out the hub and put in a bush in the hub, which does very well there. Those who used them and are so doing successfully say they stand the twisting of curves much better than the ordinary cast-iron box, and are not so liable to break off the flanges. On that account, I believe that probably the steel axle boxes will come into more use than at present. But in the meantime the greatest difficulty with cast-iron boxes has been where they were poorly designed; and where a design is defective we cannot put the blame on the material. The design ought to be worked out with consideration of the strength of the material used.

The most remarkable feat in the history of American railroading was accomplished recently on the New York division of the Philadelphia & Reading Railroad, when a special passenger train covered the distance of nearly 90 miles between Philadelphia and New York in the almost incredibly short time of 85 minutes.

The Concord & Montreal Railroad Company having had in past summers to double-head their heavy passenger trains, have had two ten-wheel locomotives built which will take the trains over the road on time without assistance. The engines have cylinders 19 x 24 inches, driving wheel 60 inches diameter, grates 78 inches long, and a large boiler with 250 7-inch flues. The engines have to pull trains for about 20 miles up a grade 80 feet to the mile.

In the Iowa House of Representatives, on April 11, bills were passed as follows: To compel railroad companies to change the name of stations to conform with the names of incorporated towns and villages at the request of the railroad commissioners; to compel railroad companies to connect crossing lines at stations by means of switches and "Ys;" to authorize the commissioners to prescribe the form of annual reports of railroads; to compel railroads to place crossings where highways are located; to compel railroads to put in private crossings.

Railway Car Construction.

BY WILLIAM VOSS.

Eighteenth Paper.

PASSENGER CAR SUPERSTRUCTURES—FRAMING.

There are many varieties of lumber that may be used for the different members of which the frame is composed, but yellow pine, ash and poplar are used to a greater extent than any of the others. Yellow pine is used for all the longitudinal members, which are the truss planks, side plates and deck sills and plates. The end plates are usually inches is probably the average size used. The posts are framed to both sill and plate with tenons, which are usually 1¼ inches thick, those entering the sill being 3 inches long and of a driving fit for the purpose of giving the car lateral stiffness.

The plates vary in size from 2 × 5 to 4 × 6 inches; the latter, size or one approximating it, is used when the plate is set on edge, as is usual in baggage and express cars. For passenger cars it is preferable to apply it with the side up, because it is desirable to have as much room above the windows as possible, and even with this, the space is insufficient when the window has but one sash, that is when not less than 2½ inches thick, 1¼ inches of which, or the thickness of the panels and battens, project beyond the face of the posts. The width is about 4 inches, the protruding portion being beveled on top where it comes in contact with the outside window sill, and grooved or rabbeted on the lower edge to receive the panels or siding. Usually the belt rail is of the same thickness as that of the panel rails, which is 1¼ inches, and is, like these, let in flush with the face of the post. To avoid the cutting away of the posts more than absolutely necessary, and at the same time add to the rigidity of the frame by locking the joints, the gains in these are not more than one inch deep, the remaining ¼

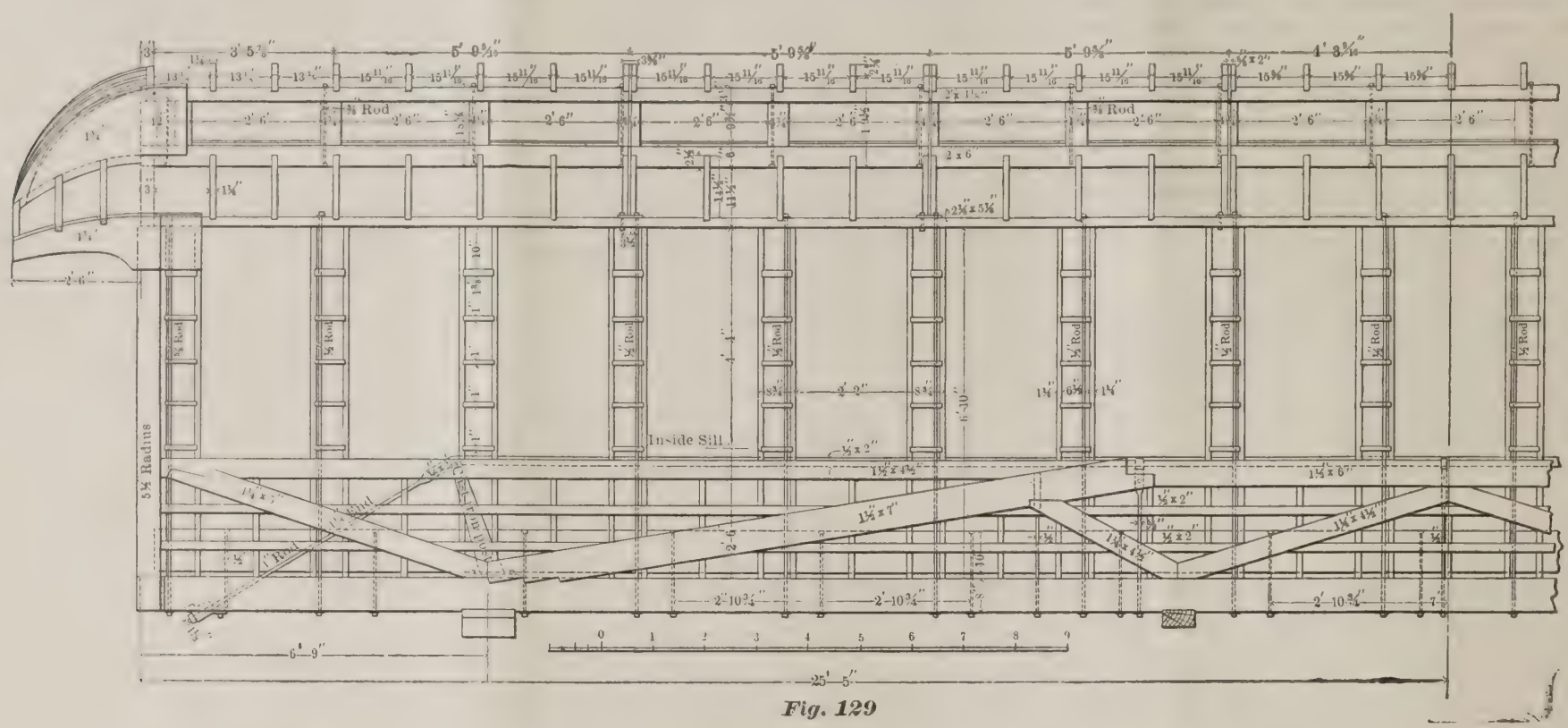
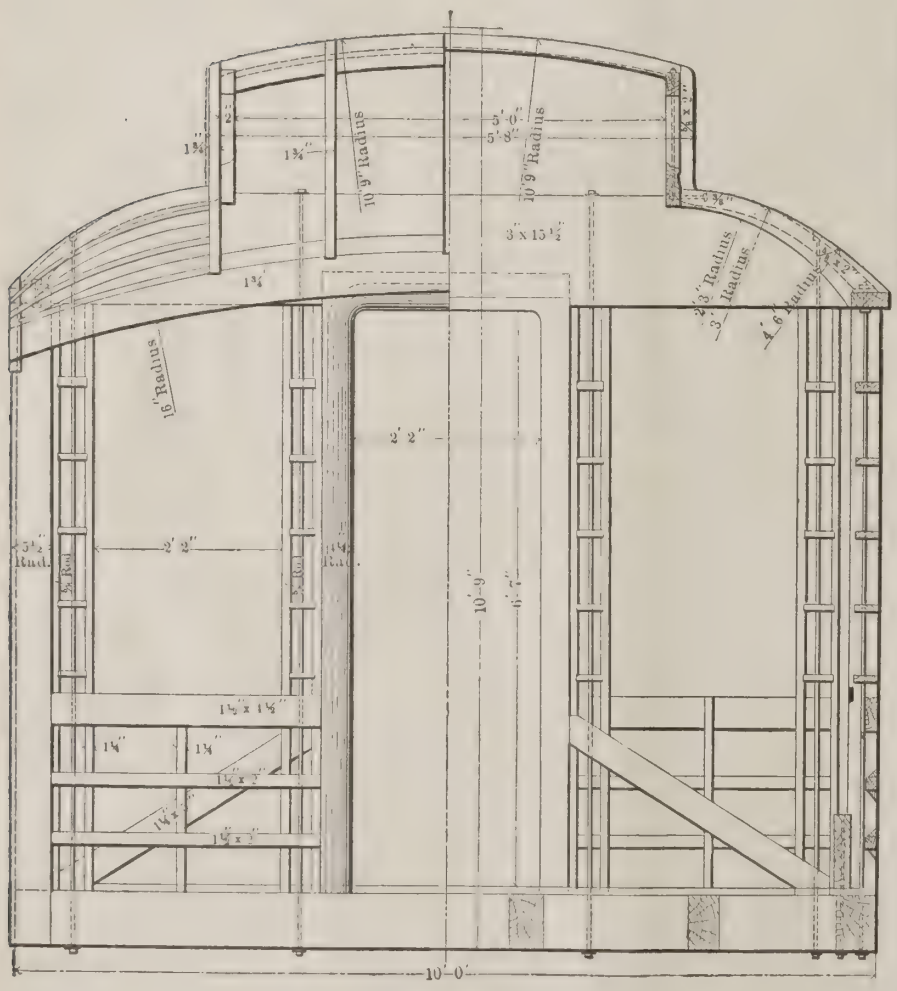


Fig. 129



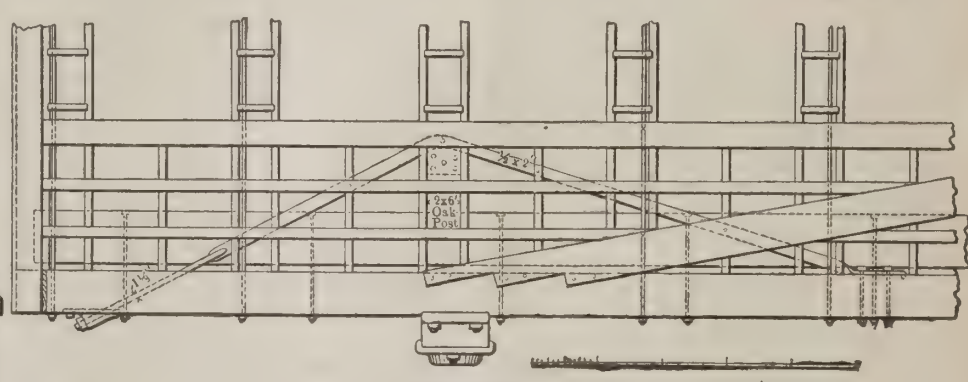


Fig. 130

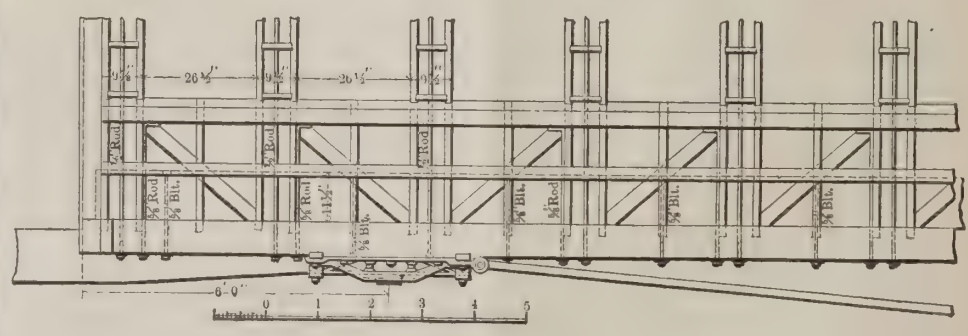


Fig. 131

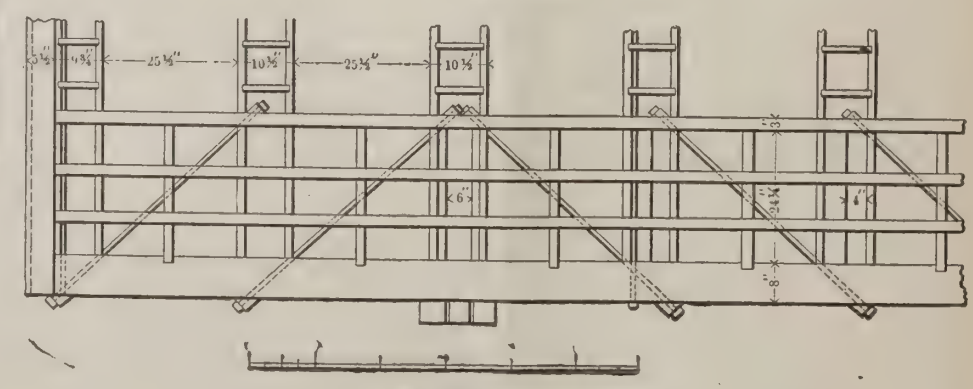


Fig. 132

of oak, the window posts, belt and panel rails, rafters and deck carlines of ash and the corner and door posts of ash or yellow poplar. In late years yellow pine has taken the place of ash in many instances, principally because it is cheaper and also because it is generally believed to be more durable, especially when exposed. The parts of the frame most liable to decay are the posts, and the particular spot the base of the windows, because more or less moisture is forced into and is retained by the joints at these points; if yellow pine, then, is superior, it should last longer when placed there; but experience teaches that it succumbs as quickly as a good quality of ash.

SIDE FRAMES.

These are composed of posts, plates, tie-rods, belt and panel rails, panel furring and whatever bracing it is possible to introduce.

In a passenger car all the full length posts, with the exception of those at the corners, are window posts; they range in size from 1⅛ to 1½ inches thick by from 3½ to 4½ inches wide, the latter dimension depending on the requirements of the window sash and blinds or curtains; 1½ by 4 it is without a transom. In such cases the plate is provided with slots, which permit the sash to ascend until stopped by the roof boards. The plate is secured by vertical rods placed at intervals of about 3 feet or at every second post; these rods are either of ⅝-inch iron and have ½-inch screw ends, or are ½ inch throughout, the former plan being adopted to reduce weight; but the reduction is small when compared with the total weight of the structure.

The outer edges of the posts are notched to receive the belt and, between this and the sill, one, but usually two, panel rails. The belt rail was formerly, and is in many instances yet, a part of the outside finish, and is in that case inch being taken from the rails themselves. The rails are secured in place with wood screws, the panel rails with one and the belt with two to each bearing.

Above the belt, when the space between the windows is not so narrow that the posts themselves occupy the whole of it, as is sometimes the case, three or four blocks, termed window panel furring, are provided. These are of pine or some other soft wood, are from ⅞ to 1½ inches thick and of the same width as the window posts when the inside panel is not let in flush, in which case they are the thickness of this, narrower. The furring blocks rest in shallow gains cut in the sides of the posts, and are fastened with glue and nails.

The bracing in the side frames of passenger cars is of necessity confined to the space below the windows, and as this is comparatively low and the different members constituting the truss are limited in size, this cannot be relied upon to carry the weight without truss rods, but if properly constructed will materially aid in doing so. There are several different styles of bracing, each of which is claimed to be the best by those using it; generally speaking, that in which the members are long and the joints consequently less numerous is less apt to sag, although it possesses the disadvantage that it cannot be adjusted when once out of shape without removing the outside covering. Any of the methods employed, however, will answer the purpose if the workmanship is good and the lumber thoroughly seasoned, especially the latter, as the closest, work is of no avail if the joints shrink open before the car leaves the shop, as is not infrequently the case. The small lumber in the frame is usually well seasoned, as this can be readily and quickly done by means of dry kilns, although lumber so treated is not so strong and durable as that seasoned in the open air. A slight shrinkage of the small sizes would be comparatively harmless, because the principal joints are not disturbed thereby; a shrinking of the sills and other large-sized longitudinal timbers, however, loosens every joint in the frame, and must in a very short time result in a badly aligned and shaky car.

The principal styles of side bracing are illustrated in the following drawings. The first of these, Fig. 129, is used perhaps more than any of the others; its parts are a compression beam, 2 main, 4 auxiliary and 2 end braces. Oak or ash was always considered the proper material to make these members of, but yellow pine has lately been substituted in this case also. Both the compression beam and the braces are 1¼ inches thick, or the same as the belt and panel rails, and like these are let in flush with the posts and secured with screws. The compression beam may be placed under and adjoining the belt rail, but usually takes the place and is a part of this, as several inches are thereby added to the height of the truss. The main braces are about 7 inches wide, and start from points on the sill corresponding with the location of the body bolsters until they meet the compression beam, the joint being usually made with sheet iron or lead insertions to prevent shortening, which is liable to occur when both surfaces in contact are end grain. A ⅞-inch tension rod, which is in this case applied with a hook end as shown, is usually provided, although there is a connection with the sill through the window posts and sill and plate rods; but this is indirect and through too many joints to be effective.

The above is frequently the only bracing provided, but many builders add to this the minor braces already enumerated. Those that were termed auxiliary braces start from or near the cross-ties, one pair meeting in the center immediately under the belt and the other two extending to some point on the main braces; they are intended to support the sill at the intermediate points, but unless the car is of extreme length this is not needed.

To support the corners, and consequendy the ends, of the car is more difficult than the supporting of the center, and the old-fashioned long brace or hog chain rod is the only reliable means by which this can be accomplished. The horizontal portion of this is rectangular in section, and is let in flush with the inside edges of the posts, to which it is usually attached with screws; to make the truss as deep as possible it is located immediately under the inside window sill, which rests on it. The round, diagonal portions are welded to the flat bar, pass through holes bored in the posts and side sill, and terminate as near the ends of the car as possible. The strain put on the rod is transmitted to the sill and through this to the bolster by a hardwood post carrying a cast-iron saddle or by a post composed entirely of cast iron.

A brace rod quite frequently used, because both weight and cost are somewhat reduced thereby, is exemplified in Fig. 130. As commonly applied, it does not keep up the end so well as the long brace, because the weight at the point where it is bolted to the sill is not sufficient to balance the strain at the end which is augmented by the action of the draw-bars and buffers, consequently this point is apt to go up and the end down. This can be remedied by locating the point of support at a greater distance from the body bolster, somewhere in the neighborhood of the cross-tie timber; but as this increases the length, and consequently the weight, of the rod, little or nothing is gained by changing from the first method. It may in this form, however, be used at the passenger end of combination cars or wherever side-door openings and other conditions will not permit a continuous rod.

The next two figures show side trusses that are preferred by many builders for the reason that they can be adjusted, and not because they are stronger; in fact, it is advisable to add the long brace rod in these cases also. Of the two, that in Fig. 132 is the best, but requires a heavy belt rail to give the rods sufficient support; these cover, however, every foot of the distance to be supported, while in Fig. 131 the large spaces under the windows are braced only.

It is reported that a party of Northern capitalists contemplate the erection, at Charleston, S. C., of a factory to build railroad cars for the South and Central American trade. It is said that the company control most of the car-wheel plants of the country, and will manufacture car-wheels in the proposed Charleston plant. The capitalists are to furnish $900,000, and Charleston business men $100,000.

Locomotive Boilers.

At the April meeting of the New England Railroad Club, Mr. H. L. Leach, of the Otis Steel Company, opened a discussion on the above subject. The following is a slightly condensed report of his remarks:

DESIGN AND WORKMANSHIP.

In the first locomotive the principles of high pressure, expansion of steam and forced draft were adopted, and the same principles are still in use, although the application of those principles has been greatly improved. In the construction of a boiler—assuming all locomotive boilers to be made of steel—care should be taken in heating the plates for flanging that the material may not be injured by overheating. If a plate is overheated it is not safe to be used, as the nature of the plate is changed and consequently weakened, and the plate at that point will be still further weakened by the rivet holes that are to be punched or drilled in the flange. All holes in plates for boilers should be drilled instead of punched, and especially all flanged plates, as they are liable to have been overheated, and if they have not been overheated the flanging is liable to cause a strain on the plate at that particular part, which the rivet holes and riveting will afterward cause to crack.

It has probably been observed by all boiler makers that cracks occur oftener at rivet holes or edges on a flanged plate than on others. If plates are punched, it is important that the punches and dies be in good condition. If their corners are worn rounding, so that they will not make a good, clean cut, they will weaken the plate. A punch or die should be in such condition that little or no depression can be observed around the rivet holes. Punches and dies are sometimes used when in such poor condition that the plates have to be laid on an anvil and a sledge used to straighten up the depression made by the poor tools. Again, when the die and punch are in poor condition, a burr is left on the under side of the hole that has to be reamed or drifted away. A rivet hole in a boiler plate should never be enlarged by a drift pin. The manner of making the seam is important. It has been customary to reinforce longitudinal seams by adding a welt. This is absolutely necessary in order to strengthen the boiler at that point as well as to prevent corrosion, which is liable to occur at the edge of a double-riveted seam when not so reinforced. Thorough annealing of all the plates is important, especially those that are flanged. Even this will not always relieve the flange of all strain on the fibres of the material, especially in the case of throat plates, which are subject to more manipulation than the others. Probably the most cracks occur in throat plates on account of the strain caused by flanging, and also because it is subject to more strain from its position in the boiler. Mr. Leach then illustrated by a drawing a theory that the expansibility of the top and the rigidity of the bottom in the first sheet in the cylinder over the fire box was the cause of many explosions.

DEFECT OF FIRE BOX DESIGNS.

A common practice in boiler construction has been the making of the fire-box shell in three plates; one on each side extending up to the circular part, and the other making the crown. This crown plate is tied to the crown bars of the fire box, and the side plates are stayed to the side plates of the inside fire box. The fire box is subject to extreme heat, and, consequently, great expansion and contraction. The fire-box plates are carried up by expansion, forcing the crown up, and with it the crown bars; and by the crown-bar stays, the outer crown plate is forced out of shape, while the lower side plates are nearly in the same condition that they were when the boiler was cold. As the seams in the circle are rigid, owing to their being double, they cannot conform to the enlarged circle, or to the form the plate would take if the seam was not there. The result is that a sharp bend is made at the edge of the seam, and although the bend is slight, the constant repetition of this strain results in furrowing or grooving the plate; and the dangerous point cannot be got at to be examined. When the flues are out of the boiler, all of the other seams can be got at and examined, and if furrowing has taken place it can be discovered and repaired; but this particular seam is inaccessible without taking out the fire box, making an expense nearly equal to making an entirely new boiler, so that any master mechanic is justified in throwing away a boiler that he has reason to suspect has these seams grooved on the edges.

It is becoming the general practice to make the whole of the back end in one plate, and I think a boiler should be made in no other way. The rolling mills of the country are now able to make plates of almost any dimensions, and boiler makers have facilities for handling them. Some say it is less work to make the back end in one plate, so there is no excuse for continuing the old and more dangerous method.

ACTION OF WATER INSIDE BOILER.

The throat sheet should have as large a circle as possible; the water space in front of the fire box should be ample to admit a large and easy flow of water, and the flues should not be too near the shell. The greatest heat and consequently the most rapid flow of water in the cylinder part of the boiler is in and around the flues nearest the center, and as that flow must be upward, a space should be left somewhere for the water to descend, and that at the coolest part. It is impossible for the water to descend around the fire-box on account of the rapid up-flow there, and as the outside of the cylinder is naturally the coolest place, plenty of space should be left there for the down-flow. I know it is held by some that when a locomotive boiler is in use, and the engine working, there is no down-flow of water which has once risen, that all the water is used up in steam, and is replaced by new water; so that when the water has once risen, it is all used up in steam. That may be the case when the engine is actually working, and the water supply is constant, and just enough to keep the water in the boiler at the proper height, but this is not the case at all times. In my opinion the obstruction to the downward flow is the cause of many explosions of locomotive boilers. I am fully convinced that the upward rush of water is so great that the flues are sometimes left bare, because enough water could not get down to replace that which was forced up. The bare flues are overheated, and when the water again comes in contact with them it causes a great and sudden increase of pressure: then if the boiler has a weak spot it gives way.

AT WHAT AGE SHOULD A BOILER BE CONDEMNED?

The question is often asked, At what age should a locomotive boiler be condemned? In answer to that I have only to say that the safety of a boiler does not depend so much upon its age as upon the material of which it is constructed. Our locomotive boilers were formerly constructed wholly of iron, and the substitution of steel was a great innovation. It has been found that steel has more of the qualities that go to fulfill the requirements of a good boiler than iron. There are iron boilers in use to-day on some of our New England roads that are more than 30 years old, and are good boilers yet. The first boiler built for a locomotive by Hinckley, more than 50 years ago, was cut up only four or five years ago, and then not because of its age nor because it was defective. There are other locomotives which are less than a dozen years old having iron boilers which are hardly safe to be used.

Mr. Lauder was much struck with the sensibleness of Mr. Leach's views, especially that the outside crown sheet should never be made in more than one piece. The old practice of two sets of sheets and a crown riveted on both sides is villainous; it invites disaster. With the higher pressures now common come higher temperatures, so that we get strains not only from the pressure, but we get it also from a greater difference in the temperature. The outside crown can just as well be made of one plate and be made very much cheaper. It does not cost as much to fit that plate as it does to put it on in three pieces. I now make the cylinder part of the boiler in one sheet, so that practically the outside shell of the boiler is composed of very few pieces.

DOUBLE-RIVETED MUD RINGS.

I have been advocating for a good many years a better form of construction in the bottom of the furnace, but I have had such remarkable success with the double-riveted mud ring that I cannot refrain from saying in public that anybody to-day who does not use it in locomotive boilers is in the position that some of our good friends the editors regard New England as being on the coupler question. Of course it will cost a little money to double the depth of the mud ring and put in two rows of rivets, but the end amply justifies the means. I have used that form of construction for ten years exclusively, and in no instance have I known of a drop of water to come from the mud ring of a boiler made in that way. Of course I should not expect any form of construction to stand that length of time without leaking in the West, where the water is very impure, but I am confident that with more care in the construction of the bottom of the furnaces the vexatious delays from leaky mud rings will be cured and will be mitigated even in the West. If I were building boilers for some roads in the West, where the water is extremely bad, I should probably adopt the Belpaire pattern.

Our double-riveted mud ring is 4 inches deep. The old-fashioned one is 2¼ inches. A ring is ordinarily 2 inches deep, and the two sheets are held to the ring with a single row of ¾-inch rivets. Locomotive builders, where they are building boilers to sell, in order to save a dollar will sometimes bend the mud ring around the corners without upsetting it. The result is that with a 2-inch ring the outer edge will scarcely measure enough to cut a ¾-inch hole through it and have anything left for caulking. No repuable maker would do that, but it is done by some builders to-day. These things can only be corrected by a thorough and rigid system of inspection, and even then sometimes they will manage to get a start of the inspector and work in a good deal of poor work. There is another thing that a great many builders do simply to save a few dollars, and that is the use of their vicious system of longitudinal staying. Instead of running stays from the back head to the front flue sheet, having them drawn straight on each head and tying the heads together firmly, they will run the stays from the back head to the shell of the boiler and rivet them on to the shell. Then they will run stays from the front flue sheet back and rivet them also to the top of the shell. That system I regard a dangerous one. When the boiler is put under pressure, the pressure on the back head will, it seems to me, draw down and throw out of place the shell of the boiler where the stays are riveted. I believe that the heads should be tied together. Within five years, and probably within two, it will be nothing unusual to see locomotives carrying 200 lbs. pressure. Even if the compound locomotive proves a failure, and we continue to use the plain high-pressure engine, I believe that at least 200 lbs. will be found to be an economical pressure. We are constantly called on for harder service. They want us to pull our trains at a higher speed, and the trains are of greater weight. The passenger locomotive is getting to be about as heavy as it should go, and the problem is how to get more out of the present weight of locomotives. A boiler that carries such terrific pressure as 200 lbs. to the square inch must be very carefully designed, the workmanship of the very best and the material carefully selected.

Recent large additions to the force of employés of the Mount Clare shops of the Baltimore & Ohio Railroad in Baltimore, Md., have increased the total number to more than 3,000 men, and that part of the city, which for a while looked desolate, has resumed its wonted prosperous appearance. Eleven locomotives are building, and many old engines undergoing repairs. A year ago the company was about to close the shops entirely, and give out at contract all its locomotive and car work, but its policy has been changed, the officials finding that is more advantageous to keep its own shops in operation. No more car-wheels or box-cars are manufactured by the company.

Locomotives Best Adapted for Heavy Train Service.

We received some time ago a communication from a railroad officer in which he spoke very disparagingly of the growing practice of using the ten-wheel locomotives for passenger service and of the position we have taken in regard to the use of many wheeled locomotives. While we were considering what had best be done with that letter, we received another from a superintendent of motive power, asking for information respecting the relative value of eight-wheel and of the larger sizes of locomotives for passenger and freight service. We then thought that the most reliable answer could be obtained from the men who had had experience with the various types of engines, and we accordingly applied to the leading master mechanics for the required information. We have received a large number of letters in reply, and select below the salient points from some of the letters. Many writers merely said that they could give us no information, or words to that effect. We thank these gentlemen as cordially for their courtesy in replying as we thank those from whose letters extracts are given.

We are compelled, through limited space, to leave over some of the letters till next month.

Mr. J. R. Groves, of the St. Louis & San Francisco, sends us a statement of the cost of operating eight-wheel engines and ten-wheel engines in passenger service. No comparison can be made of the relative expense of the two types of engines for the reason set forth in Mr. Groves' letter, which says :

We are using ten-wheel passenger engines on a portion of our road, and in a general way we can say that they give entire satisfaction, though we cannot give you the comparative statements you ask because we have no eight-wheel engines in service on the section of road that our ten-wheel engines are in use on. The service of ten-wheel engines is on portion of road with heaviest grades. Our eight-wheel engines take the same trains through over portions of road with light grades, and all ten-wheel engines are in heavy service while many eight-wheel engines are in particularly light service, such as branch passenger service.

Mr. Charles Graham, Delaware, Lackawanna & Western, anticipates having to put ten-wheel engines running passenger trains as the trains become heavier.

Mr. J. B. Barnes, Wabash, writes:

I am very sorry indeed that no definite data is at hand, as we have not been keeping records from which facts concerning this matter could be gleaned that would be of value to you.

I confess that for myself I am an enthusiast on the ten-wheel subject, and believe in adopting them for all classes of service except branch passenger and freight runs.

On level roads, eight-wheel engines can no doubt be operated economically, but with the system of overloading engines, that railroad companies seem to insist on, the eight-wheel engines are expensive to keep in repair, and I am confident are more severe on the track and road bed.

It surely is but a question of time when the ten-wheel locomotives will be in the majority on all trunk lines.

Mr. Geo. A. Ferguson, Concord & Montreal, is just putting the first ten-wheel passenger engines into service. They have been using the same class of engines with smaller wheels in freight service for five years with excellent results. His people think they could not do the work with eight-wheel engines.

Mr. J. W. Luttrell, Newport News & Mississippi Valley, says:

I am not able to speak definitely upon the subject, as I have never used the ten-wheel engines in passenger service. So far as handling freight trains is concerned, I find the ten-wheel engines preferable to the eight-wheel engines. The ten-wheel engines are as light on fuel and oil as the eight-wheel engines, and a greater number of cars per train are handled. The cost of repairs on ten-wheel is a trifle in advance of the eight-wheel engines, but the difference is more than balanced by the increase of tonnage per train moved by the ten-wheel engines. As to passenger engines for level roads, or roads with a maximum grade, say, of 30 feet to the mile, and a maximum curvature of four degrees, I would recommend the three-wheel engines for the following reasons: First, there are fewer bearings to cause delay by heating; second, there are fewer parts for the engineer to look after, oil, etc. In designing a machine for any purpose, I believe in as few parts as possible. On such roads as Chesapeake & Ohio, Baltimore & Ohio, or the mountain division of the Pennsylvania, I would recommend the ten-wheel engines for passenger service. I believe you will bear me out in the assertion that a great many able men adhere very tenaciously to absurd ideas, often for the reason that they fathered them, or because they have been advocated by those in authority over them. The requirements on similar roads are often very dissimilar, and engines should be designed to meet the requirements. They should be designed with a view of handling their trains easily on the heaviest grades and to be economical in the consumption of fuel. In conclusion, let me say that a man in charge of any department of the railroad service should have moral courage to change his opinions whenever convincing evidence is produced, and when practical test demonstrates the fact that ten-wheel engines are better adapted for the traffic on his road than eight-wheel engines, he should not hesitate to recommend and encourage their adoption.

Mr. L. M. Butler, New York, Providence & Boston, writes:

As a preface of what I am about to say in answer to your inquiry, I must admit that I have never had any experience with ten-wheel engines in passenger service. But from experience with them in freight service have concluded that they are not a desirable class of engines for passenger service, particularly if high speed is desired, providing the eight-wheel engine can be made to do the work. On this road we have no difficulty in doing all that has been required with the eight-wheel class of engines, with a margin of power in reserve, Now for reasons (after recognizing the fact that that weight-producing adhesion is an important factor, as well as power in hauling the trains of to-day) first, it is obvious that cost of maintenance must be increased on account of extra pair of driving wheels and extra side rods and other necessary fixtures. The middle rod brasses wear much more rapidly than either end, requiring extra care and adjustment, and at the best soon get to running badly, on account of main boxes wearing also, and can only be trued with the rods by removing the wheels and removing or refitting linings. I also consider the liability to accident and train detention to be nearly double what it is on an eight-wheel engine, on account of this extra machinery. And I hesitate to recommend any additions or complications to machinery to haul our trains with, unless I find that it is necessary to increase the adhesion of our locomotives beyond what can be done with those of eight wheels. I will endeavor to explain the train service here, and at same time give you a description of the engines doing the work. I think by it you can more fully comprehend my position in this matter.

Our Shore Line trains consist of an average of eight cars. They are heavy cars, too, as you are probably aware; but our engines can pull 11 cars and make our time. I will, for example, note the mail train. It always has nine cars, consisting of one 60-foot mail car, one 60-foot baggage, one smoker, two coaches and four sleeping cars; total of nine; estimated weight, 310 tons, besides engine and tender. Time between Providence and New London, one hour and 45 minutes; one stop. Have run it in one hour and 30 minutes when behind time. This train runs nights. Have pulled 11 cars and made time. The locomotive that does this work is from Manchester Locomotive Works, built in August, 1888. I had two of them just alike. The one on the mail, No. 43, has always been on that train. Description and performance as follows: Cylinder, 17 × 24 inches; diameter of drivers, 68 inches; boiler diameter, 54 inches; has 206 flues, 2 inches diameter × 11 feet 1 inch; fire-box, 35 × 72 inches; carries 180 pounds steam; weight on drivers, about 63,000 pounds; round trip is 128 miles: amount of coal, round trip, averages three tons. Last month (March) she made 31 round trips, 3,968 miles (train); car mileage, 35,712; amount of coal, 93 tons.

With such excellent showing and satisfactory service, I feel safe in saying that this company are a good ways from requiring a ten-wheel locomotive to handle their trains with. We have our ten-wheel engines in freight service that pull a train of sixty eight-wheel cars over this road, Providence & New London, and are working first-rate, and are better engines for that service than an eight-wheel would be. Finally, it is my judgment that the cost of maintaining a ten-wheel engine in passenger service on this road would at least be increased 40 per cent. over and above our eight-wheel engines doing the same work.

How about the compounds and the Strong locomotives? You know, I presume, that I am an advocate of the Strong, and am inclined to believe that kind of engine will and can make a better showing than a compound will or can. The record of tests shows up the Strong first-rate; others have got something to do to beat it. They certainly have not done so yet.

Mr. G. A. Haggarty, New Brunswick Railway, writes:

I have never operated any ten-wheelers in passenger service, but I know that in freight service they are far superior to eight-wheel engines, but could not give you the relative cost per mile run, as we have but one ten-wheel engine here, which is a freight engine. I should judge that where they have business to warrant the use of ten-wheel engines the increase and percentage of cost in operating compared with the work done would be very light. I am a believer in ten-wheel engines for heavy service.

Mr. J. S. McCrum, Kansas City, Fort Scott & Memphis, says :

I have not had any experience with ten-wheel locomotive in passenger service, therefore anything I might say would be only an opinion. For all ordinary passenger service on comparatively level roads I think the eight-wheel engines are recognized to be satisfactory, but for heavy fast trains I have no doubt but the ten-wheel engines are much more efficient; in fact there is no other type of engine that I have had any experience with that I regard as favorably for the general service. In regard to the relative expense of fuel and repairs, I regret to say that I have no data that is sufficiently reliable to use, but venture to assert that the average cost for repairs on our ten-wheel engines are less than our eight-wheelers. They run more miles without being taken off their wheels than our eight-wheelers in freight service, and as the matter of tire wear is what brings our engines into the shop more than anything else, there is always a certain amount of repairs that follow when the engines are jacked up that otherwise would not be done.

Mr. David Holtz, Western Maryland, says :

My experience has been limited with ten-wheel locomotives on passenger trains. We have four 18 × 24 inches cylinder ten-wheel locomotives with 56-inch drivers which are run on both freight and passenger trains with satisfactory results. This road is neither straight nor level, but the reverse in both respects. I am favorably impressed with ten-wheel locomotives for heavy passenger service.

Mr. James M. Boon, West Shore, writes:

Referring to your letter of the 8th, I have not made competitive trials of the economy of eight and ten-wheel locomotives on a level road pulling all kinds of trains. In comparing the efficiency of the two classes of engines, the earning capacity of the engines should be the basis on which to work. I am of the opinion that the ten-wheel engine will give the best results on either a level or road with grades.

Some time ago the question came up as to the number of cars freight engines were pulling over a certain piece of road. To ascertain this, a careful record was kept for four months. No effort was made to increase the load. The time being fall and winter, the trains were slightly below those hauled in summer. The cars were all loaded. The idea was to ascertain the work engines were doing in the ordinary run of business. Some of the engines were just from shop, others in fair condition, and others about ready for general repairs. The average was "good condition." There were three classes of engines doing the work:

1st class, with 18 × 24-inch cylinders, 66-inch drivers, eight-wheel engines.

2d class, with 17 × 24-inch cylinders, 60-inch drivers, eight-wheel engines.

3d class, with 18 × 24-inch cylinders, 54-inch drivers, ten-wheel engines.

It was found the

1st hauled 28.3 cars, making schedule time.
2d " 27.9 " " "
3d " 30.8 " " "

Showing that the ten-wheel engine hauled 2.5 cars more per train than engines with same size cylinders but with larger wheel. The weight of the engines was about the same and same boiler pressure, viz., 130 lbs. The ten-wheel engines were on fast freight, and schedule time was slightly faster than those on the ordinary freight.

The cost of repairs per mile run, was:

1st class	.0064
2d class	.0098
3d class	.0067

The ten-wheel engines used more lubricating oil, due to the additional pair of wheels and rods. The coal was not weighed. There was no apparent difference in consumption as all the engines made the same run with one tank of coal.

The most notable item of expense working eight and ten-wheel engines is the tire. With same weight on drivers the eight-wheel engines will wear out nearly two sets to one on a ten-wheel engine, making the same mileage. The wear of tire on a heavy eight-wheel engine is very rapid.

Have not used ten-wheel engines on passenger trains. Would not hesitate to do so, if business on the road was heavy enough to call for more powerful engines in preference to running trains in sections.

I do not know whether this letter will be of use to you. It appears to me to be pretty late to call into question the economy in using ten-wheel and consolidated engines. It has been demonstrated over and over again in increased earnings and reduced expense in M. of W.

Mr. G. W. Stevens, Lake Shore & Michigan Southern, writes:

The movements of this company's passenger traffic is confined to the eight-wheel type of engine and the freight traffic to the eight-wheel type of engine and the mogul. We have four ten-wheel Schenectady build of engines, bought some years ago for freight traffic, but they became entirely too small after a time for the business, and have for several years been in switching service.

At this writing there are under construction for this company, at the Brooks Locomotive Works, 20 17×24-inch cylinder ten-wheel freight engines. The object in selecting this type of engine instead of the mogul, was for the reason that an arbitrary limit of weight per driving wheel was fixed upon; and, in order to get sufficient boiler capacity, and not exceed the limit, the ten-wheel engine was chosen, which permitted weight in the aggregate to be about the same as that of a mogul and less upon the driving wheels, in consequence of carrying greater weight upon the engine truck.

Mr. C E. Smart, Michigan Central, writes :

Referring to your letter of April 8, asking what information I can give you as to the relative value of eight and ten-wheel locomotives on all kinds of service, and what percentage of increase of passenger and freight trains has been effected by substituting ten-wheel for eight-wheel engines, etc.

In replying to your inquiry I have to say that with the exception of the test that we made in Canada, we have never made any test that would enable us to give the exact figures to show how the tonnage was increased per train with ten-wheel engines as compared with the eight-wheel American type. It has been my intention to make a test extending over a period of two or three months, but there has never been a time since we put the ten-wheel passenger engines in service that we could spare them from passenger service long enough to put them on freight to make the test, consequently I could not give you the figures in freight service except in a general way. However, I have my opinion regarding the matter, and, as far as I am concerned, feel perfectly satisfied. Will refer to this later on.

You will remember at the time you were here I showed you a sheet giving the comparative performance of eight-wheel engine No. 416 and ten-wheel engine No 432 on the Canada Southern Railway, a test made for thirty days, from Sept. 15 to Oct. 15, and I was under the impression that I gave you a copy of this, or that you took the figures down, but thinking perhaps you may not have taken the statement, I will enclose it herewith, and will make reference to it in making further explanation.

This test was made for our own information, and it was not intended to publish it in the shape that it was made, but the test so made answered for our own information so that we could draw our own inferences as to the comparative merits of the two engines. It was impossible for us to make a test of the engines, one against the other, running on the same division, as it was impossible for the eight-wheel engines to make running time on the same division upon which the ten-wheel engines were running and handle the same trains, as the eight-wheel engines could not make the time as before stated. Therefore, it might be said that it was hardly a fair comparison, as the engines were not running on the same division.

As regard the two engines making the test, I would refer you to the inclosed specification of the ten-wheel engines, which will give you the weight of engine, grate surface, heating surface, etc., which may be handy for you to refer to, and will state for your further information that the eight-wheel engine in competition with the ten-wheel is a Schenectady built engine; weight in working order 88,000 pounds; total weight on drivers, 58,000 pounds, with driving wheel 69 inches outside diameter, being one inch larger than the ten-wheel passenger engines have. These engines were both engaged in our heaviest fast passenger service, as shown on the inclosed sheet. As there might be a question in your mind as to the difference between the east and west divisions as to grades, etc., I would say that practically there is very little difference between the two divisions, but I am of the opinion, there being a few more stops to be made on east division than on the west division, that the east division is a little the hardest division to take a train over. But in summing the matter up, the conclusion we reached in the test was that everything else being equal, *i. e.* weight of train hauled, miles per hour, etc., that the eight-wheel engine burned over forty per cent more coal to do the same amount of work than the ten-wheel engine did. I think in looking over the performance sheet that you will agree with me that we could claim considerable more saving than this, but I do not wish to make what might appear an exaggerated claim.

With reference to the position taken by your correspondent who contends that your position is wrong in regard to the economical service rendered by ten-wheelers on level roads, I would say that there might be some question in regard to the advisability of using a ten-wheel locomotive in passenger service on a level road where light trains could be handled to good advantage by eight-wheel engines, but where trains are very heavy, and the time to be

made very fast, there is no question in my mind in regard to the economy of ten-wheel engines similar to what we have in service, for the reason that when a ten-wheel engine is handling a train at her maximum capacity, she is doing her work more economically as regards fuel than the eight-wheel engine, on account of the large increase in grate surface and heating surface over the eight-wheel engine. I speak now with reference to the shallow fire box in ten-wheel engines sitting above the frame, which makes it possible to get the large grate surface (twenty-eight and one-half square feet) by extending it over the frame and the driving axles, which grate surface cannot be obtained where the deep fire box is down between the axles.

The heating surface of our ten-wheel engines you will see is about forty per cent. more than that of the ordinary 18 × 24-inch eight-wheel engines.

I feel perfectly safe in saying that where we are obliged to make an average of 50 to 55 miles per hour with a train consisting of a baggage car, two coaches and five sleepers, a total of eight cars (or any heavy train at an increased speed), that even if it were possible for our eight-wheel engines to make the time, that they would consume nearly 40 per cent. more fuel in doing the work than our ten-wheel engines would, for the simple reason that in such a case the ten-wheel engine can burn her coal economically on account of the increased grate surface and heating surface, while under the same circumstances the eight-wheel engine is being worked, so to speak, beyond her capacity and cannot consume her coal economically. This fact we have fully demonstrated, and while I am of the opinion that there would not be quite as much difference between the engines in freight service, I think that our 10-wheel engines will show nearly as good results in freight service compared with eight-wheel engines as they do in passenger service, providing we were to work each engine to its *maximum capacity* in *fast freight service.*

I am aware that the expense of repairs and cost of maintenance in the case of the ten-wheel engines is somewhat more than it is with eight-wheel engines, but, taking into account the increased amount of work that they do, and the profits resulting therefrom, the ten-wheel engines have the advantage.

I might go further and take up other points in connection with this matter, or the question might be raised if the performance of the ten-wheel engine is due to the increased grate surface, why an eight-wheel engine could not be built in the same way and give equally as good results? This question would lead to other questions, but my idea regarding the increased amount of work done by the ten-wheel engines over what an eight-wheel engine is capable of doing, and doing economically, is in the fact, not only of increased grate surface and heating surface in boiler, but the weight on the drivers, which determines the amount of work an engine is capable of doing; and, as we all understand, it would be impossible to carry the same amount of weight which the ten-wheel engine has on four drivers and run such an engine at any rate of speed; and the very fact of its not being possible to carry the increased amount of weight on four drivers, would seem to debar the eight-wheel American type of engine from ever competing successfully with a ten-wheel engine in heavy passenger or fast freight service. If your correspondent can devise some means whereby he can carry 96,300 pounds on four wheels, and do it successfully at a high rate of speed, you may perhaps then be obliged to concede that such an engine might compete successfully with a ten-wheel engine as long as her tires lasted. I think even then there would be some doubt as to whether such an engine would be successful.

Mr. George W. West, New York, Ontario & Western, writes:

My experience with ten-wheel locomotives on passenger trains has been so limited that it would not amount to very much. On level roads I can see no advantages, as there certainly are some objections, such as an extra pair of rods and wheels to keep up, and not as convenient to work around or under. But for an all-round engine there is no doubt it has some advantages over an eight-wheel engine. I believe that on any road where an engine of 100,000 pounds will do the work, it can be done more economically with 8 wheels than with 10. When it is necessary to add more weight than 100,000 or 105,000 pounds to do the work, then the additional pair of drivers come in to good advantage. My experience on the Erie gave me an opportunity of seeing this worked out to my entire satisfaction, but not long enough to say anything for others. The eight-wheel engine known as the class M on any train but their vestibule, which is heavy and fast, can do better work and for less money than the class O Baldwin ten-wheeler. On the vestibule, the class O is decidedly the best engine, which to my mind is proof that there is a service for both classes of engines. As regards the percentage of increase of trains hauled by the eight-wheel engines, I do not think there is any until after you go above 100,000 pounds. The advantage that the class O have over the class M on the Erie is not all in the extra pair of drivers, they having one inch larger cylinder. At the time I left the Erie, we had never had one of the class O in shop for general repairs. There was no advantage in running repairs or fuel that the ten-wheeler had over the eight-wheeler.

Mr. F. D. Casanave, Pennsylvania lines west of Pittsburgh, writes:

We have not used any ten-wheel locomotives in passenger service, because the capacity of eight-wheel locomotives is ample to haul our heaviest passenger trains.

Should the traffic increase and more cars need to be hauled, we would use the engines with three pairs of driving wheels and pony truck in preference to the present type, because we could then design a larger boiler, and add the weight necessary to utilize the power of the larger cylinders without detriment to the journals and bearings.

In eight-wheel engines, the limits in these directions have been reached.

We have used consolidation ten-wheel engines of the class I type for freight service for several years with very satisfactory results on level roads.

These have replaced the eight-wheel engines heretofore used in freight service. With the former, the number of cars hauled has been doubled.

The cost of repairs of the larger engines is less than that of the smaller ones.

We cannot give you comparative figures, because the cost of the new engines built to replace those retired from service has been charged to repairs.

When rebuilding is done, we will be in a position to make comparisons with former years.

Our observation, however, enables us to say very positively that larger engines can operate freight trains more economically than smaller engines, both as to cost of repairs and fuel, provided the traffic is such that the engines can at all times be loaded to their full capacity.

Mr. E. B. Wall, Southwest System, Pennsylvania Lines, writes:

It has been so long since we have used eight-wheel locomotives to any extent in freight service that we are unable to give any facts concerning these two classes of engines in that service, and as we do not use ten-wheel locomotives in passenger service, we are also unable to give any facts concerning the relative economy of the same engines in this service.

The introduction of another pair of driving wheels to freight locomotives, or changing from the ten-wheel to the consolidation locomotive, has resulted with us in effecting a saving of about 20 per cent. in freight service. We cannot say, however, that an equal saving can be effected by the use of the ten-wheel engine in passenger service instead of the eight-wheel, though we are inclined to believe that a saving would be made.

The figure given above of 20 per cent. saving includes all items, such as fuel, repairs, wages of enginemen and trainmen, and increased car mileage. As far as the items of fuel and repairs are concerned in the case of the ten-wheel passenger engine, we think that for the work done a saving would be made.

Mr. W. H. Thomas, East Tennessee, Virginia & Georgia, writes:

Since our ten-wheel passenger engine was placed in service we have not been fully able to test its capacity, owing to the fact that our through passenger trains have been lightened by putting on an increased number of local trains, so that we have not had an opportunity to see what the ten-wheeler could do. So far as we have tried this engine, however, we have found it capable of handling our heavy passenger trains and making running time on our heavy grades, where our eight-wheel engines invariably lose from two to three minutes on each grade, consuming less fuel than the eight-wheel engines, which leads me to the conclusion that the 10-wheel locomotive is the most economical of the two.

While we have no data at hand to show the percentage of increase of passenger and freight trains by the use of ten wheel instead of eight-wheel locomotives, nothing has transpired in my experience to lead me to conclude otherwise than that the former is the most econmical.

After some contemplated changes are completed in our ten-wheel passenger engine, we expect to test it more thoroughly, and also to indicate it, and will advise you of the result.

Mr. Allen Cook, Chicago & Eastern Illinois, writes:

In regard to ten-wheel engines for heavy passenger trains, will say that we have no trains heavy enough to require them, and can not give you any data in regard to expense for fuel and repairs between the two engines; but in my opinion, when you need an engine above 45 tons to draw and make fast time with the very heavy passenger trains of modern times, you should by all means have a well-built, compact, ten-wheel engine, so as to distribute the great weight over more given points, necessary for the large boiler to make the steam to do the work successfully, as it appears almost impossible, with such heavy engines to keep the bearings cool with only two pairs of drivers. Then again they are, or I should consider them, much harder on the track, bridges, etc., at high speeds; then again you get more adhesion with the ten-wheel, and a more powerful engine, although you have a little more machinery to revolve.

Mr. James Meehan, Cincinnati, New Orleans & Texas Pacific, writes:

An eight-wheel engine, up to 18 × 24, doing the work desired by a railroad company, I consider the most economical, if the engine is properly designed. A road desiring better work than this class of engines are capable of giving would certainly find that a ten-wheel or mogul engine is the most economical.

For passenger service I prefer the ten-wheeler. For freight service on straight road, or a fairly straight road, I prefer the mogul.

Some time since we found it necessary to increase the size of our engines for the Mountain Division from 18 × 24 eight-wheel engines to 19 × 24 ten-wheel engines. The result was excellent, the ten-wheelers performing the work in good shape with 25 per cent. more cars in train, while the consumption of fuel was about the same.

We have no eight-wheel engines on this system hauling freight trains, however, our equipment for that purpose being all moguls and consolidation engines. There can hardly be any doubt of the economy of ten-wheel engines over the eight-wheel engines in the transportation department, nor that the eight-wheel engines are less expensive to keep up. I have no hesitation in saying that for heavy passenger service the ten-wheel engines are decidedly better than the eight-wheel engines.

Of course, with your practical experience, you can readily understand how much better the distribution of weight can be made on the ten-wheel engines than on the eight-wheel engines.

The information given above is the result of our experience.

Mr. L. H. Turner, Pittsburg & Lake Erie writes:

Replying to yours of the 8th inst., we are hardly in a position to give you much information on the subject. We have on our line 26 ten-wheel engines in freight service, with 18 × 24-inch cylinders and 44-inch wheel centers, hauling 50 loaded cars per train. We get about 3,600 miles per month out of them on 60-mile divisions; this will show that they can be kept busy and not much time consumed in making running repairs. We can give you no comparative figures between the eight and ten-wheel engines from the fact that we have none that are similar in size and weight. We think we are getting as good service from our freight engines as any one can get, but will have to say that for high speed we would not use 10 wheels when eight would do the work, for these reasons, that none of our engines are perfectly balanced, and the more wheels and higher speed, the harder they are upon themselves; and then the additional pair of drivers, boxes, rods etc., to maintain. Possibly we might change our views after having experience with ten-wheel engines in passenger service, but for heavy work we think they are what is required. We have a very fair record of what our engines are doing, and if there is anything further that we can furnish you it will be a pleasure for us to do so.

Mr. R. Atkinson, Canadian Pacific, writes:

If the rail in use weighs not more than 60 pounds to the yard, I consider the safe limit for driving wheel is 15,000 pounds, and that the largest eight-wheel engine it is advisable to use on such a rail would therefore be one with 17 × 24 cylinders, total weight about 90,000 pounds; and if larger loads must be hauled than such an engine will draw, then and not until then should the mogul or ten-wheel engine be adopted, and if either of these designs are used I consider the safe weight for driving wheel should be 1,000 pounds less than for the eight-wheel engine.

A similar comparison may be drawn for any weight of rail, for instance: If a 70-pound rail be used, the eight-wheel engine may have 16,500 per driving wheel, with cylinders about 18 × 24 and a total weight of 100,000 pounds. The ten-wheel engine for the same rail might then have 15,500 per driving wheel.

I consider it premature to make any statement of the work performed by ten-wheel engines on this road. As to the percentage of increase in haulage, it should vary directly with total weight on drivers, as the power of the engine should vary with the same proportional weight.

Master Mechanics' Association.

During last month the secretary of the Railway Master Mechanics' Association has sent out a circular of investigation asking for information on the "purification or softening of feed water" and one asking for facts about "brick arches," for the committees having the subject in charge. A circular was also issued intimating that the next convention will be held at Old Point Comfort, Va., with headquarters in the Hygeia Hotel. Parties wishing to secure rooms are requested to apply to the manager of the hotel. The master mechanics who have not already answered the circulars of inquiry are requested to do so without delay, as the reports must be sent in by the beginning of June.

Master Car Builders' Association.

Secretary Cloud, of the Master Car Builders' Association, has sent out a circular, giving the names of 19 railroad companies that have become parties to the Rules of Interchange of Cars. The notice adds:

In several instances roads in this list have been adhering to the Rules of Interchange for two or three years, but their names have not appeared in the list at end of Interchange Rules, owing to a misunderstanding, a belief on the part of some representative members that the appointment of such a representative by their several companies implied an adhesion to the Rules of Interchange, which is not the case. The Rules of Interchange are binding upon those who share their benefits, while all the actions of the Association have only a recommendatory character, therefore, the List of Roads at the end of the Code of Rules embraces only such railroad companies as have given specific notice to the Secretary that they wish to become parties to the Rules of Interchange, as provided in Rule No. 28 of the revision of 1889, and by a similar rule in earlier revisions.

All interested parties are requested to see that proper advices are given to the Secretary if any railroad companies desire to have their names added to this list.

The New York Central, the Pennsylvania, and the Cincinnati Southern railroad companies are using alloys of copper ingots for driving boxes and find the practice economical.

Steam Snow Machines.

At the April meeting of the Northwestern Railroad Club, Mr. J. S. Leslie gave an interesting talk about the work done with the rotary steam snow plows in fighting the great snow blockades on the Pacific coast last winter. Mr. Jones, president of the Cyclone Snow Plow Company, also spoke of the fine performance of the cyclone plow. He concluded his remarks: When I see a plow, whether rotary or cylone, do as much work in ten or fifteen minutes as it was estimated it would take 200 men four days to throw out with a shovel—and snow, too, that could hardly be removed by push-plows, engine plows or anything else, on account of the depth and density—it satisfied me that steam power will be universally used in the future; and I think that the railroad people will, from now on, have as much to do in developing it, and perhaps more than the inventors or the manufacturers of the plow. I think that they will be the most competent to improve them and make them meet all the needs of the railroad service.

After the meeting closed Mr. Leslie exhibited to a number of friends a great variety of photographs taken during the prevalence of the snow blockades in California and Nevada. Many of the scenes were very striking. Railroads, houses, and even towns were shown buried deep under an avalanche of snow. In many cases nothing of large houses was to be seen except the tops of the chimneys. In numerous instances the rotary snow plow was shown bravely contending with the elements, and pouring out the great stream of snow that so quickly transfers the obstruction from the track to the open country. The latest built rotary plows have a decided improvement in the cutting wheel, the knives delivering the snow into a cornet-shaped passage which carries it freely into the fan chamber without danger of choking.

The plows constructed last season were built in the Grant Locomotive Works, Paterson, and are said to be much more satisfactory, so far as workmanship is concerned, than those previously built.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

MAY, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Locomotive Boilers for High Steam Pressure.

The discussion that took place at the April meeting of the New England Railroad Club, reported in another column, deserves to be carefully read by all who are responsible for the safety of locomotive boilers. The introductory by Mr. H. L. Leach, which is an excellent essay on locomotive boiler construction, elicited very little discussion, which was no doubt due to the fact that there was little said which admitted of difference of opinion. We were, however, surprised to find that so few of the railroad men present were disposed to express themselves on the general subject of boiler construction, for the varieties in designing details are so great in practice that individual preferences must be very decided. The subject of boiler construction has been of great interest to master mechanics, if we are to judge by the attention devoted to it by the Railway Master Mechanics' Association; for until lately it has nearly always been annually under investigation by a committee. The increase of steam pressure has risen so rapidly within the last five years, that it seems highly proper and seasonable to renew the discussions about locomotive boilers, for a revival of investigation is likely to throw needed light upon the capacity of the boilers commonly made to resist the enormous tension that fashion is calling for and making imperative. When the operative department of a railroad finds that the locomotives belonging to a rival company are carrying decidedly higher steam pressure than those operating their trains, and that a greater number of cars are hauled in consequence, potent influences are soon put in force to induce the mechanical department to screw down the safety valves of their locomotives. This is sometimes done without calculations being made of the resisting power of the boilers concerned. The effect is to reduce the margin of safety, which has always been too small in American locomotive boilers.

Locomotive boilers carrying a working pressure of 160 pounds to the square inch are now becoming very common, and the demand is for still higher tension, so it is probable that 200 pounds per square inch will be the ordinary working pressure before the century is ended. This increase of pressure is accompanied by increase of size, so the strains to which the plates are subjected are increased in two ways.

Our mechanical engineers have displayed a surprising fondness for the wagon-top boiler with fire-box supported by crown bars. Although mechanically a weak form of construction, this boiler has done very good service, and has been deservedly popular, but it is particularly unsuitable for large sizes and intensely high pressure. In an ordinary wagon-top, crown-bar fire-box the tendency of the steam pressure is to force the inside fire-box downward out of the shell. This is resisted by the staybolts and the mud-ring fastenings, which have to sustain the stresses transversely or in the line of their smallest resistance. The result is that there is more or less movement all the time, so that staybolts break off and mud-rings leak. The breakage of staybolts sometimes permits the side of the fire-box to be blown out even with the small surfaces that have been in use. The larger surfaces coming into vogue and the higher pressure upon them will make the danger much greater under the new order of service.

For high pressure and large surfaces, a form of boiler is necessary where all the stresses can be resisted by material put under direct tensile strains. The straight cylindrical boiler with the fire-box secured to the shell by means of strong bolts, is a much stronger form of boiler than that with the wagon top and crown bars. The crown bar arrangement has maintained popularity because it looks stronger than it really is. If master mechanics would examine carefully the relation between the outside and the inside of the fire-box, they would be forced to the conclusion that crown bars not properly stayed to the shell is a dangerously weak method of supporting the crown sheet. Those who are wedded to the wagon top because of the increased steam room provided, can secure the same advantage by using a Belpaire top. In this form of fire-box, which is universal in Belgium, and has been used considerably in this country, the strains are resisted by stays that receive the tension straight and in the line of their greatest strength. The downward pressure on the inside crown sheet is counterbalanced by the upward pressure on the outside sheet, so that all the stresses are borne by the stay bolts joining the two surfaces. A secondary advantage of no small value is, that a stayed crown sheet is much easier kept clean than one having crown bars. Those who are familiar with the use of the Belpaire fire-box say that there is much less trouble with side staybolts breaking than there is with a crown-bar fire-box.

The dangers of the practice of putting longitudinal seams at the sides of the outside shell of a fire-box were freely expressed at the meeting of the New England Railroad Club. This practice is no longer necessary, and no railroad company ought to accept a boiler so constructed. All first-class makers of good boiler plate roll sheets large enough to form the outside shell from one piece, and the chances are that joined sheets are of inferior material.

Although most master mechanics will call it rank engineering heresy to say so, the practice of using lap joints for longitudinal seams of boilers is a most defective method of joining the plates together, and ought not to be permitted in boilers intended for very high pressure. The reinforcement of the seam by means of a single welt is a perfunctory arrangement that might as well be dispensed with, for under tests it has been shown that the welt adds nothing to the strength of the seam. The most mechanical seam and the method of joining plates that ought to find favor with soundly trained mechanics, is the butt joint with double welts. When the plate is increased in thickness beyond $\frac{5}{8}$ inch, the strength of a lap joint does not increase in proportion to the strength of the thicker plate, but a butt double welt joint, besides being stronger with thin sheets than a lap joint, keeps up its proportion of strength as the thickness of the sheets is increased. For this reason the butt welt joint is essential with a high-pressure boiler made of sheets thicker than $\frac{5}{8}$ inch.

The form of design is of great importance to the construction of a reliable boiler, but of even greater importance is the securing of good material. Many railroad men have kept clinging very tenaciously to iron as a material for boiler shell construction, but there is no more wisdom in that choice than there is in the choice of iron for fire-boxes or for rails. A committee of the American Boiler Manufacturing Association made a very thorough investigation lately into the best material for boilers, and they reported strongly in favor of steel, a decision which is upheld by nearly all other modern authorities on boilers. It is important, however, that the steel used be of good quality and suitable for boiler shells. Many railroad men ordering boilers have been in the habit of specifying a certain make of steel for fire-boxes and permitting the builder to put his own choice of material into the boiler. The greater part of locomotive builders will not risk their own reputation by putting inferior steel into boilers, but there are others who care for no consideration except buying from the cheapest market. To guard against the risky effects of such a policy, purchasers of locomotives ought to specify the steel to be used in boilers as well as in fire-boxes, and require that it should show certain physical qualities. Steel for locomotive boilers ought to pass a test at least as searching as the steel used in boilers belonging to the United States Navy. The naval requirements for boiler steel are that the tensile strength shall be from 55,000 to 65,000 pounds per square inch; the elongation shall be 20 per cent. for plates $\frac{5}{8}$ inch in thickness or less, and 22 per cent. for plates from $\frac{5}{8}$ to $\frac{3}{4}$ inch Up to $\frac{1}{2}$ inch in thickness the steel plate should be capable of being doubled over and hammered down on itself without showing any signs of fracture, and above that it should be capable of being bent round a mandrel of a diameter equal to one and a half times the thickness of the plate to an angle of 180 degrees without signs of breaking. Railroad companies ought to see for themselves that the boiler plate used will meet these requirements. Those that have testing laboratories can easily make the tests for themselves, and those that do not have a laboratory can get the tests made at places like the Hunt Bureau of Tests, or some such institution. If these requirements were rigidly exacted, more than one concern now supplying boiler plates would find their business seriously crippled. It is only a sound business policy and the promptings of common sense to specify the quality of the material to be used in boilers. Those who neglect this precaution neglect an important duty. We have known of boiler sheets that failed to pass the inspection of an establishment where a tests department was maintained, being shipped to another shop where no systematic tests were made and accepted without question. This transaction is very suggestive.

In the discussion in the New England Railroad Club the practice of punching the holes for rivets was condemned and drilling recommended. We think there is likely to be considerable diversity of opinion on this point. When sheets are punched by boys or any other cheap class of labor, and the work done so unskillfully that severe drifting must be resorted to before the rivets can be put in, then punching produces an inferior job. But if punching is done skillfully with clean cutting tools we cannot see that the operation is inferior to drilling, for any strains that may be imparted to the edge of the rivet hole will be relieved by the annealing action of the hot rivet. The effect of this annealing action of the hot rivet has always been overlooked by those who compare the strength of a drilled and a punched sheet. Punching has been made unpopular through the work being badly performed.

There are other features that require special attention in boilers intended for very high steam pressure that want of space compels us to leave untouched for the present.

Ignorance About Brakes.

"A Railroad Director" writes us at some length about the Hamburg accident on the Lake Shore & Michigan Southern, and while admitting the progress made in the perfecting of brakes, blames the imperfections of the air-brake for causing the accident. His remedy for the danger so arising, is to substitute a machine electric brake which has received very little application to railroad cars, and which no unprejudiced person capable of judging would think of offering as a proper brake in competition for that now in use on nearly all passenger trains. The latest Hamburg accident was not due to imperfections of the air brake, but to the ignorance and carelessness of the men responsible for using it. There are happily few great railroads in the country where the trainmen are so ignorant about brakes as those on the Lake Shore railway are. It is only a few months ago since a well-known superintendent of motive power was traveling over the road on an express train, and he found that at every starting po'nt there was difficulty in releasing the brake of the car he was in. Considerable time was lost by the bad start made due to dragging the brakes of this car. The trainmen looked at it several times, and then the conductor decided to cut the brake out. He and his brakemen discussed for several minutes how this operation could be performed; then they tried to do it, but none of them had the least idea of what ought to be done. After they failed to do what they wished the superintendent of motive power showed them how to perform an operation that every one of them ought to have been familiar with.

When a passenger train crew at this late day failed to cut out the air from a car, it is not surprising that none of them on a subsequent occasion failed to realize that the engineer could not release the brakes on a train when a conductor's valve was left open. The officers of mechanical departments of railroads are taken very sharply to task when it is found that any men under them are deficient in the knowledge requisite to perform their duties efficiently; but there has been criminal laxity about the instruction of men belonging to other departments. The issuing of a general order requiring all trainmen to make themselves familiar with the mechanical appliances of cars is a very perfunctory way that some operating officers have of performing their duty toward the traveling public. Competent managers have competent men, because they make certain that the necessary knowledge and skill are required.

American Locomotives in New South Wales.

Our English engineering exchanges are in the habit of waxing exceedingly wroth if any one has the temerity to suggest that the American type of locomotive is in favor anywhere away from the North American continent, yet there are happenings in British colonies which the engineering journals find very hard to explain away. This is conspicuously the case in New South Wales. A few years ago the locomotive superintendent of that colony, Mr. Thomas Midelton, attracted considerable attention and brought no small amount of abuse upon himself by patronizing a kind of engine which was an American mogul with a pair of carrying wheels under the foot-plate. That became known as the Midelton locomotive. Its leading rivals were Scott engines, which were common six-wheel English locomotives.

About two years ago a political change took place in New South Wales, and the ins turned out Mr. Midelton, and a new railroad commissioner who came into power set about remodeling everything on English patterns. He was a London and North-Western man filled with the belief that any practice which deviated from that of the great English railway was wrong. He had appointed as exponent of mechanical ideas Mr. Wm. Thow, a locomotive superintendent from New Zealand. Changes proceeded rapidly, and for a time the New South Wales journals were full of the improved performance that would result when

the railroads were stocked with the Simon-pure English locomotive. A change appears to have come over the spirit of the dream lately. We find the following article in a late issue of the Sydney *Morning Herald:*

There has been quietly going along in our Railroad Department, despite official repression, a trial which is of the utmost importance to the people of this country. That trial has reference to the type of locomotive, and it is undoubtedly now clear that the Midelton pattern completely beats that favored by Mr. Scott and by Mr. Thow. It is an open secret that all the engine drivers consider the Midelton engine in every way the best, and their testimony is supported by load results and also by results in wear and tear of the permanent way. Briefly summarized, the advantages are as follows: The Midelton engine will take a load anywhere of between 120 and 140 tons, or 40 tons more than the other engines; and they can with this extra load do the distance between Sydney and Albury, 386 miles, in ten hours, or about two hours less than the other engines. The Midelton engine maintains an even speed on all gradients, whereas the others fall below goods train rate on ordinary gradients, and in making up time going down a bank shatter the permanent way in a most dangerous fashion. The Midelton engine, by reason of the extended wheel base, rolls over the line; the other engine, being of contracted wheel base—that is, shorter in length—rushes through the rails, and plays up terrifically with the road. The Midelton engines carry their water for 70 miles, instead of about 30 to 40. The type of locomotive favored by Mr. Thow are a heavy cost to the country, and they must be displaced at every opportunity. The actual result is illustrated in this fact. The northern mail now seldom leaves Sydney without two engines. This must be done if there is an extra carriage, or even an extra horse-box. One engine will not take the load; but a Midelton engine by itself will take out the load with 40 tons added, and keep the time right through to New England. Although no official statement has been made to the effect, it is nevertheless an undeniable fact that the reason why Mr. Eddy (the new Railroad Commissioner) cannot keep his trains to time is the unsuitable locomotive resources at his command. In view of these facts, it is satisfactory to note the arrival of five of these Midelton locomotives from the celebrated Dubs Works, England, where they were constructed on the Midelton specifications. All the engine drivers hail their arrival with satisfaction. The question of these locomotives is of the utmost public importance, especially to those people inland identified with agricultural and pastoral work. The general use of the Midelton engine would clear the way for a permanent reduction in goods, as well as passenger rates, and that is the sole difficulty ahead of us in New South Wales. We have a vast inland territory whose wealth has never yet reached the seaboard. We must soon not only be masters of our own coast markets, but be winning competitors in the outside markets of the world, and whatever or whoever stands in the way of such an accomplishment must be brushed aside.

The plain English of all this is, that the leading daily newspaper of New South Wales is doing its best to convince the people of the colony that the only way to move passenger and freight trains promptly and at the least possible cost is by the general introduction of American locomotives. The Dubs locomotives referred to in the article were seen by the writer in Glasgow a few months ago, and they are close patterns of moguls formerly built for the colony by the Baldwin Locomotive Works, and designed by Mr. Midelton.

Brake Beams.

The report on "brake gear for air brake cars," submitted to the last Master Car Builders' Convention, appears to have exerted a wonderful proselytizing effect in relation to the use of iron brake beams. Before that report was published there were some iron brake beams in use, but the number was very small and most of them applied were experimental or put on as a reluctant acknowledgment that the company concerned were willing to try any promising improvement. The companies that are now refraining from specifying iron brake beams for new cars are exceptional and the conservative decision that leads to the ordering of wooden brake beams is attracting comment. No improvement previously introduced upon railway machinery ever met with such ready and general acceptance. The change from the weak, yielding, short-lived wooden beam to a light, strong, and durable iron beam is a progressive move that will quickly prove a remunerative investment to the companies adopting the improvement. Meanwhile, it is strange to witness the struggles made by the officers of some companies to stem the tide of progress, and retain the time-honored wooden brake beam for a service it has ceased to be equal to. When hand brakes alone were used, the wooden brake beam was sufficiently strong to withstand the strains it was generally subjected to, and no demand for a change would have obtained adherents. But when power was applied to the operating of brakes a rigid, unyielding brake beam became necessary, and men's minds appear to have been for years getting gradually converted to this necessity; so that when the committee of the Master Car Builders strongly recommended the use of an iron brake beam, the preponderance of railroad opinion favored accepting the change without a question. There is always, however, a small minority that must act contrary to the majority, and in the case of the brake beam this element holds fast to the old material. We are not surprised to find railroad companies that do not see their way to adopt in the near future air brakes for freight cars specifying wooden brake beams, but the action of those who are ordering air brakes for freight cars, and specifying wooden brake beams at the same time, is rather incomprehensible. To those who are persistently clinging to the wooden brake beam we would respectfully commend the following extract from the report of the M. C. B. committee already referred to:

"Your committee very strongly advises against the use of wooden brake beams, either plain or trussed, as it is entirely impracticable to design them to meet the requirements without increasing their cost fully as much as that of the iron beams, without gaining any of the durability of the latter."

Most of railway men must be aware that the above protest against the use of wooden brake beams was made, yet we find some master car builders industriously exerting all the resources of mechanical ingenuity to brace and truss the wooden brake beam into the semblance of a reliable member of the brake mechanism. But after all the labor and all the expense put upon it the combination beam has a wooden foundation that will rot into dust before the compression member of the iron brake beam shows the first signs of weakness due to age or service.

The Fittest Type of Locomotive.

The letters published in another part of this paper from master mechanics, giving their views as to the kind of locomotive best fitted for various kinds of train service, will be found interesting reading. The so-called "American" eight-wheel locomotive has been a great favorite with all classes of railroad men. It is a particularly convenient engine in many ways, and its most valuable features are of a character that make the machine popular with those who come most in contact with it. That type of engine is convenient to handle, easy to repair, and pulls the kind of trains that are easily controlled by the men immediately in charge and by those who are responsible for the safe movement of trains. But the limit of the capacity of this form of engine for handling freight trains was years ago reached, and on many roads the limit has been passed for passenger service. When the necessity for using locomotives with more than two pairs of driving wheels for hauling freight trains became apparent to those interested in keeping down operating expenses, the need for a change was not evident to the rank and file of railroad men, and persistent opposition was raised against the heavier class of engines. The heavy engine has slowly but surely come into use, but the change received little aid or encouragement from many of the men whose duty it was to help into successful operation anything calculated to improve the means of moving cars.

Locomotives of greater boiler and tractive capacity than what can be carried conveniently on two pairs of driving wheels are now in course of introduction for passenger service, and in many quarters the change is unpopular. The manifestations of a wide-spread prejudice against large locomotives may be noted in the letters of our correspondents, but the writers, as a rule, display remarkable readiness to change away from the beaten track when a change becomes absolutely necessary. There may be wide diversity of opinion as to what constitutes the proper time for adopting the larger engine. We believe that some of our correspondents who are still using eight-wheel engines for passenger service, and express themselves ready to change when the necessity arises, have long passed the point where eight-wheel locomotives have ceased to be economical. If an engine cannot pull the ordinary trains without constant forcing she has become too small for the service. When an engine is too small for the general work she is a particularly expensive machine to operate. The ten-wheel engines put into passenger train service on the Canada Southern division of the Michigan Central did the work with 40 per cent. less fuel than good eight-wheel engines that were previously doing the work. There are very good reasons for believing that many eight-wheel locomotives operating heavy passenger trains are doing the work much more wastefully than those that were displaced on the Canada Southern. A saving of 40 per cent. in fuel would soon pay the expense of introducing the most approved type of locomotives.

A vigorous fight has been raging for some time among the steel tire makers of this country, and prices have been forced away below the cost of producing steel of the high quality necessary for making good tires. We have nothing to do with the business policy actuating this conflict, but we can assure all parties concerned that most of the users of tires are by no means gratified with the struggle which has given them tires cheaper than they were ever supplied with before. There is a widespread impression that a cheap article necessarily means the supply of an inferior article, and railroad companies cannot afford to use inferior tires at any price. There have been at different times struggles among the makers of cast-iron wheels for supremacy in the business and in consequence prices were depressed away below cost, with the invariable result that the article supplied was of the most defective character. The railroad companies that become purchasers of the cheaper grade of wheels always found the practice extremely costly in the end, and those who have been burned in this process naturally fear to be scorched again in a trade which is so closely analogous to the cast-iron wheel business. In the last three months we have been repeatedly questioned by those responsible for the character of material put into rolling stock as to what we know about the effect of the low prices upon the quality of the tires made. Others have plainly intimated that they would not take the risk of buying tires made under the low prices prevailing, for they felt sure that the quality must be reduced in proportion. There are so few makers of steel tires, and the supply of an inferior article brings its own punishment so certainly and promptly, that we do not think makers can afford to materially lower the quality, but all concerned are welcome to accept the impression made on customers by the cutting of prices.

On another page will be found a very interesting letter from our correspondent "Progressionist," describing in a strikingly clear and succinct manner the two systems of joint car inspection that are most successfully in operation. We commend a careful study of the article to those interested in the prompt movement of cars. The delays that occur so frequently to freight through disputes arising from the conflicting interests controlling the interchange of cars in many important yards bring the car departments into disrepute with many railroad managers and lead to no end of heart-burnings. A properly organized system, such as any of those described by our correspondent, has proved the means of facilitating the movement of cars and of preventing misunderstandings. The system that produces this effect is worthy of extended application, and we feel certain that many master car builders would advance the interests of the companies they serve, and materially increase their own comfort by having a good system of joint car inspection introduced at their exchange points.

The comments which we made in our last issue on an order by President Mackey, of the Evansville & Terre Haute Railroad system, requiring officers and clerks to be in attendance at their work punctually at 7 A. M., has elicited a reply from a correspondent, whose letter will be found among our communications. Our correspondent defends the spirit and letter of the order, and takes us to task for expressing a different view of it. We still believe and contend that our position on this question has been perfectly fair and just, and consistent with promoting the best interests of the railroad service. Mr. Mackey's order was directed principally at clerks and the men in charge of work, such as foremen and higher officers Men of this class are among the hardest worked and worst paid of any in our great railroad army, considering the importance of the duties performed. It is not the common practice to require these men to begin work punctually at 7 o'clock, nor is it the custom to pay them for extra work during busy times. If they belonged to a class of men that are in the habit of combining for mutual support and protection, there would probably be less inclination displayed to inflict petty exactions upon them. Movements like that of the Mackey order are what encourage men to combine together for defensive and offensive purposes, and give point to the arguments of the demagogue, who urges upon his supporters arguments convincing them that strikes are a necessary and paying means of conflict.

A correspondent sends us an extract from the Boston *Herald* containing some "space work" written by some young "journalist," who apparently was sent out to a railroad yard to get materials for a romance. How long the entire article was we do not know, as our correspondent has considerately torn off a portion of it; but in the eight inches sent we find that locomotives, in the latitude of Boston, have their boilers washed out once in three months, and that preparatory to this the *foreman* of the roundhouse blows off the steam through the *whistle*.

The above is an extract from an editorial in the *Railroad Gazette* dilating upon the ridiculous trash that the average reporter produces when he attempts to write up railroad matters. We have a suspicion that the writer of the editorial is very much in the condition of the young journalist whose production he holds up to ridicule. He evidently is not aware that many locomotive boilers in the latitude of Boston are washed out only once in three months, and that it is a common practice to blow off steam through the whistle. Many sage reflections are made in the *Gazette's* article about the foolishness of employing novices to write up subjects they do not understand. We cordially agree with these sentiments, and think they might with advantage be applied in the office where they emanated.

In another column we publish a letter from a correspondent in New Zealand on the most economical way to handle a locomotive. The ideas of Mr. Bowles are not different from those we have been for years urging upon the enginemen of this country, but the subject will bear repetition, and our readers will be interested in seeing that railway engineers in New Zealand are following the line of progress that has so many advocates in America. In a private letter our correspondent speaks highly of the interest taken by New Zealand railroad men in the NATIONAL CAR AND LOCOMOTIVE BUILDER and in the book "Locomotive Engine Running and Management." There is no doubt that the New Zealanders are progressive people, and we have no hesitation in saying that they are preparing themselves for the high mission the historian Macaulay prophesied for them.

The summer meeting of the American Society of Mechanical Engineers will be held at Cincinnati, O., beginning May 13. President Ingalls, of the Cleveland, Cincinnati, Chicago & St. Louis, will receive the visitors, and deliver an address of welcome. There is very little in the business that will be of interest to railroad engineers.

Personal.

Winslow Judson, president of the St. Joseph, St. Louis & Santa Fe Railroad company, died at St. Joseph, Mo., from paralysis of the brain.

Mr. Thomas Howard, for some time division master mechanic of the Delaware & Hudson shops at Oneonta, has been made general inspector of the Baldwin Locomotive Works, Philadelphia.

Mr. John S. Silver has resigned as vice-president of the National Car Spring Company. He is president of the Charleston, Sumter & Northern Railroad, which demands the whole of his time.

The announcement has been made that Mr. Gavin Campbell, general superintendent of the Wisconsin Central, will act as general manager during the absence of Mr. S. R. Ainslie who has been ordered abroad for his health.

Mr. Charles A. Ball, who has resigned his position of general superintendent of the Georgetown & Western, was presented with a handsome gold-headed cane by the employés of the road last week on his departure for New York.

President Norton, of the Louisville & Nashville, was severely injured a few days ago by being thrown out of a buggy. Railroad men with a proper regard for their own safety do all their riding on the substantial buggies that run on steel rails.

The president of the New York Central & Hudson River Railroad has given a vacation to 13 engineers who have been 30 or more years in the employ of the company, and paid the expenses for them and their wives through the West as far as Salt Lake City.

William Galloway, who ran the first locomotive on the Baltimore & Ohio road, died at Baltimore April 6. Mr. Galloway was probably the oldest railroad engineer in the world. He was retired from the Baltimore & Ohio in 1887. He was born Sept. 21, 1809.

Mr. Thomas B. Burnett, general superintendent of the Peoria & Pekin Union road, has resigned to accept a position with a California road. Mr. Burnett has been in railroad service since 1862, and has held the position he has just resigned since December, 1881.

Mr. Thomas G. Nock, president of the New York Locomotive Works, died at Rome, N. Y., April 20. Mr. Nock was president of the works named since 1881, and was also president of a bank in Rome. He had been in failing health for some time and died after a brief illness.

It is announced that Mr. J. T. Harahan, late general manager of the Chesapeake & Ohio and formerly general manager of the Louisville & Nashville, has accepted the position of general manager of the Louisville, New Orleans & Texas road, with headquarters at Memphis, Tenn.

Mr. David Banderali, chief engineer of the Northern Railway of France, died recently at Paris. Mr. Banderali visited this country several times, and the many friends he made will regret to hear of his death. Many of the improvements which he designed for the rolling stock of the Northern of France were suggested by his experience on American railroads.

Mr. J. R. Taylor has been appointed general manager of the Rome & Decatur Railroad, to succeed Maj. George D. Lawrence, resigned. Mr. Taylor has been in the service of the Atlanta & West Point, Western of Alabama and Queen & Crescent. He was superintendent of the Pine Bluff, Monroe & New Orleans, and later was executive secretary to the president of the Mexican National.

Mr. E. M. Roberts, for several years master mechanic of the Ashland Coal and Iron Company, has been appointed master mechanic of the East Tennessee, Virginia & Georgia, with headquarters at Atlanta, Ga. Mr. Roberts is a highly progressive young man, and has been noted for the fine condition in which he kept the rolling stock under his charge, although his facilities for doing work were very limited.

It is reported that Mr. Roswell Miller will soon relinquish the duties of general manager of the Chicago, Milwaukee & St. Paul, retaining the office of president, the combined duties of the two offices having been found too laborious for him. No railroad in America has made more rapid progress into the condition that brings prosperity than the Chicago, Milwaukee & St. Paul under Mr. Miller's active management.

Mr. R. N. Campbell has resigned as superintendent of the Council Bluffs Division of the Chicago, Milwaukee & St. Paul road, and goes to the Island of Jamaica to take the management of a railroad there. Mr. Campbell began railroad work as a telegraph operator on the Louisville, New Albany & Chicago, and held important positions on several Western railroads before joining the company he has just left.

Mr. C. W. Walker, of the Seaboard & Roanoke, has met with a great bereavement in the loss of his wife, and has the kindly sympathy of all who know him. After fifteen years of hard savings—savings carefully hoarded—they were about to move into their new and beautiful home, when, almost without warning, death separated them—only for a time. This blow, coming so soon after the death of a lovely daughter, makes it doubly hard to bear.

Mr. G. M. Beach, formerly general manager of the Cleveland, Columbus, Cincinnati & Indianapolis, but since last June general manager of the Chicago & Atlantic, has resigned this position. It was under the management of Mr. Beach that the Cleveland, Columbus, Cincinnati & Indianapolis emerged from chronic impecuniosity to prosperity. He is a very quiet, unpretentious gentleman, but he knows how to run a railroad on a paying basis.

Mr. John Chamberlain has been appointed master car builder of the Boston & Maine to succeed Mr. D. C. Richardson, resigned. The announcement will give pleasure to a host of friends who are interested in the upward progress of Mr. Chamberlain. He graduated from under the enlightened tutelage of Mr. F. D. Adams, of the Boston & Albany, whose assistant he was for several years and left there to become superintendent of the car works at Wichita, Kansas. He receives a warm welcome back to New England.

The following well known gentlemen have been appointed directors of the World's Fair, Chicago, to represent railroad interests: Marshall M. Kirkman, second vice-president Chicago & Northwestern Railway; Stuyvesant Fish, president Illinois Central; J. C. Peasley, vice-president Chicago, Burlington & Quincy; Charles C. Wheeler, a railway officer of high capability and long service on the Chicago & Northwestern and other important lines, and E. T. Jeffery, ex-general manager of the Illinois Central.

Mr. J. H. Vreeland, formerly master mechanic of the Erie, at Jersey City, and now manager of the Beals Brake Company, New York, was lately presented by some of his former subordinates on the Erie with a handsome gold watch and chain. As Mr. Vreeland has been out of railroad employment for six months and is not in the position to give favors to the donors, it is certain that the presentation was inspired by a genuine spirit of respect for a gentleman who was long a faithful and efficient officer of a company which has very frequently failed to hold competent men at their true value.

The recent selection of Gen. George W. Bentley, of New London, Conn., as vice-president and general manager of the Charleston, Cincinnati & Chicago Railroad, is a fit recognition of one of the ablest and most experienced railway men in the country. Gen. Bentley has been engaged in railway work more than forty years, is a man of extraordinary force of character, industrious, practical, thorough and conscientious, and possesses in a marked degree the very elements which the duties and responsibilities of the position to which he has been called seem to require. The property placed in his charge is a most important one, but its owners need have no fear that it will not be wisely and successfully managed.

Mr. H. B. Stone, second vice-president of the Chicago, Burlington & Quincy Railroad has tendered his resignation, to take effect June 1. He retires from the railway business to become president of the Central Telephone Company. He has been occupied in railway work for 12 years, beginning his career in the mechanical department of the Burlington, of which he became vice-president. In 1880 he was made superintendent of the locomotive and car departments. The next year he became general superintendent of the road, and later attained the offices of assistant general manager and general manager. The great "Q" strike was the grand mistake of Mr. Stone's life, although he was more passive than active in deciding to enter the fight.

Perhaps one of the most striking illustrations of appreciation of pure and simple merit in railway circles is the case of Mr. Chas. D. McKelvey, general superintendent of New York, Susquehanna & Western Railroad. He left this road less than a year since as superintendent at a salary of $3,000 and accepted the managership of the Grand Central Depot yards and terminals at a salary of $6,000. Within some six months from date of departure negotiations were under way leading to his return to the Susquehanna & Western, and an offer of $7,000 per year was made and met by the New York Central people. Then $8,000 was offered and met by the Central. A three years contract was added as an additional inducement on part of Susquehanna, and before Central was given another chance, accepted by McKelvey. He left the Central with the assurance that $10,000 would have been paid by them rather than have lost his services. The handling of the enormous business on this six miles of track is "no fool of a job" and his ability in this direction was so marked that money was no considera tion. What he has done for the Susquehanna & Western since his return would make interesting reading.

New Publications.

SLIDE VALVE GEARS.—An explanation of the action and construction of plain and cut off slide valves, by Frederick A. Halsey, member of the American Society of Mechanical Engineers, etc. New York: D. Van Nostrand Company. Price $1.50.

There is nothing connected with mechanism that engineers are more interested in than slide valve gears, yet men with limited education have had a hard road to travel in becoming familiar with the action of valves and valve gearing. There is nothing very mysterious about valve gears, but the subject has been rather unfortunate in the writers who have undertaken its elucidation. It has been a favorite theme with the profound mathematician whose disquisitions have put a verbal mist of difficulty over very simple movements. And certain intensely practical men have undertaken to explain all about valve gears before they had themselves learned the rudimenis of their action. Mr. Halsey evidently understands all about valve gears, and he also realizes that a teacher in this line of instruction ought to adopt simple methods. He has followed the graphical treatment, and has worked it out so clearly that any intelligent man with a little perseverance will soon understand the whole of the treatise.

AIR BRAKE PRACTICE. By J. E. Phelan, superintendent Northern Pacific Railway, etc. *Locomotive Engineer*, New York. Price, $1.25.

The principal part of this book was written when the author was traveling engineer of the Northern Pacific Railway, and when he was doing his best to put plain information about the air brake before the trainmen of the road. There is nothing about the construction or use of the air brake which Mr. Phelan is not familiar with, and he has put what he knows into very readable form. He is a clear, forcible writer, and possesses the faculty of explaining mechanical apparatus and operations in a way that common men can understand. This book ought to prove a valuable aid in dispelling the ignorance about air-brake practice that still prevails among the trainmen on many railroads. It gives explanations of everything relating to the brake that any one needs to learn, and there is very little in the book but which all trainmen ought to be familiar with. The book would make a much-needed supplement to the train rules of all railroads.

DIRECTORY OF PATENT SOLICITORS, LAWYERS, ETC., edited and published by the *Journal of Useful Inventions*. New York. Price $1.

This volume of 260 pages, besides being a very carefully and accurately compiled publication of the names and addresses of all the men in the legal and other professions and trades connected in any way with inventions, throughout the United States and Canada, is brimful of useful and interesting information; and as the publisher's purpose is to issue and revise it every three months, it is bound to become, as it is intended to be, the standard hand-book of the profession and the reliable guide for all people interested in patents. Special attention is to be paid to all recent decisions in patent matters.

Assistant General Manager, promoted from Yale College, enters chair car, calls brakeman and asks why the car is not warmer. Brakeman answers, "because Baker heater is in wrong end." Assistant General Manager asks brakeman to give him number of the car so he may order it sent to the shop for the purpose of taking out Baker heater and having it placed in right end of the car.

Vice-President King, of the Baltimore & Ohio Railroad, to-day submitted to the citizens of Cumberland a proposition to make that the termini of the second and third and Pittsburgh divisions of the road, and to concentrate the machinery employés now engaged in repairing its locomotives in Martinsburg, Keyser, Piedmont and Connellsville, affecting a change of 2,000 men. They also propose to erect extensive shops and track at the eastern section of the city, making this and Baltimore the two largest repair shops on the road. In consideration of this they ask the city to loan them $150,000, which is to be repaid by the company at the rate of $10,000 per annum, without interest; the first payment to be made two years after the date of the city bonds issued for the loan.

The Old Colony Railroad Company are building in their shops in South Boston an eight-wheel compound locomotive designed by Mr. F. W. Dean, the well-known mechanical engineer. The boiler was designed by Mr. J. N. Lauder, superintendent of rolling stock and made to carry a working pressure of 200 pounds to the square inch. It is 56 inches diameter, has butt joints and double welts and is a particularly strong type of boiler. The engine will have two cylinders, a high pressure at one side and that for working the low-pressure steam at the other, after the style of the first Mallet form of compound locomotive. The high-pressure cylinder is 20 inches diameter and is steam jacketed. The low-pressure cylinder is 28 inches diameter. The stroke is 24 inches. Two reverse levers are provided with the view of regulating the cut off to suit the work. The driving wheels are 69 inches diameter, and the truck wheels are steel-tired, 36 inches diameter. All details of the machine are admirably worked out.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Ninth Paper.

FOUR-CYLINDER COMPOUND LOCOMOTIVES.

There are two general classes of four-cylinder compound locomotives, one of which embraces all designs in which a receiver of large capacity is used, and in which the angles between the cranks are comparatively unimportant, while the other includes only those engines in which the high and low pressure pistons are on one piston rod, or are otherwise rigidly connected, and the "dead space" between the cylinder is reduced to a minimum. The first class includes those locomotives which have two inside connected high-pressure cylinders and two outside connected low-pressure cylinders, and also Mr. Mallet's double bogie compound locomotive. The second class comprises tandem engines and those of the Vauclain type, in which the high and low pressure cylinders are placed side by side and both pistons are connected to one crosshead.

The elementary theory of four-cylinder compound locomotives of the first class is essentially the same as that of two-cylinder receiver engines, and the four-cylinder type may be regarded, as far as the cylinders are concerned, as formed from the two-cylinder type by substituting for each cylinder of the latter two cylinders having a joint volume equal to the corresponding single cylinder. It was shown in discussing two-cylinder receiver engines that in making approximate calculations to determine proportions, the receiver pressure may be regarded as constant without serious error, assuming that the capacity of the receiver is large compared with that of a high-pressure cylinder. It follows from this that the distribution of work in the cylinders is practically independent of the angle between the high and low pressure cranks when a large receiver is used. If in a four-cylinder engine, both high-pressure cylinders exhaust into one receiver, which is the reservoir from which both low-pressure cylinders are supplied with steam, the variations in pressure in this receiver during a revolution will presumably be less than in a two-cylinder engine. We can, therefore, in the design of four-cylinder engines, make use of formulas which are based upon a constant receiver pressure, proceeding at first as if the engine were to have but two cylinders. The formulas are those which are usually given for two-cylinder receiver engines, and are not of special value in the design of two-cylinder compound locomotives on account of the necessity of a very careful analysis of the steam distribution in that type of locomotive if the possible advantages of compound working are to be realized.

In subsequent formulas the letters have the following meaning:

v = volume of high-pressure cylinder.
V = " " low-pressure cylinder.
R = ratio of the cylinders, $V = R\,v$.
r = ratio of expansion in h. p. cylinder.
r' = " " " " l. p. "
p_1 = pressure in h. p. cylinder during admission.
p_2 = pressure in h. p. cylinder when exhaust opens.
p_3 = mean pressure in the receiver.
" = pressure in l. p. cylinder during admission.
p_4 = mean l. p. back pressure.
All pressures are absolute pressures.

Neglecting the effects of clearance, the mean forward pressure in the high-pressure cylinder is

$$p_m = \frac{1 + hyp.\ log.\ r}{r} p_1$$

The mean effective pressure is $(p_m - p_3)$ and the work done in the high-pressure cylinder during a stroke is $v(p_m - p_3)$. Similarly, the mean forward pressure in the low-pressure cylinder is,

$$p'_m = \frac{1 + hyp.\ log.\ r'}{r'} p_3$$

the mean effective pressure is $(p'_m - p_4)$ and the work done in the low-pressure cylinder during a stroke is $V(p'_m - p_4)$.

If the work is to be equally divided between the two cylinders, $v(p_m - p_3) = V(p'_m - p_4)$.

On the basis that volumes vary inversely as the pressures, we have,

$$p_2 = \frac{p_1}{r} = \frac{p_3 V}{r' v} = \frac{p_3 R}{r'}$$

By substituting the value for p_3 obtained from this equation in the preceding one, and reducing, the following is obtained:

$$\frac{p_1}{1.r}\left(hyp\ log\ \frac{r}{r'} - \frac{r'}{R}\right) + p_4 = O. \quad (4)$$

By means of this equation the ratios of expansion in each cylinder (r and r') for which the work done in each will be equal can be determined for any assumed values of p_1 p_4 and R. If it were required that there should be no drop in pressure at the end of the expansion in the high-pressure cylinder, p_2 must equal p_3, from which it follows that r' must equal R. It will be found that equation (4) will give impossible values for r' for many values of r. As r becomes less, or steam is admitted to the high-pressure cylinder during a large part of the stroke, r' will be found to be less than one which is manifestly impossible, and shows that with a late cut-off in the high-pressure cylinder the work cannot be equally divided between the cylinders. On the other hand, as r is made large, r' also increases until it is greater than R which is an impracticable result, as the receiver pressure would then be higher than the pressure in the high-pressure cylinder at the end of the expansion. For example, if we take $R = 2.3$, $p_1 = 190$ pounds absolute, $p_4 = 20$ pounds absolute, and $r = 1.33$, or cut-off at 0.75 of the stroke in the high-pressure cylinder, the equation reduces to *hyp. log* $r' + .4348\ r' = 0.3904$ from which $r' = 0.97$. As steam is admitted during the whole stroke when $r' = 1.0$, it is clear that with the above proportions more than one-half of the total work is necessarily done in the low-pressure cylinder. If r is taken as equal to 4, with the other data the same as before, the value of r' will be found to be 3.75, or the low-pressure cut-off would have to be placed at $1 \div 3.75$ or 0.267 of the stroke. But as there will be no drop in pressure between the cylinders when $r' = R$, or when steam is cut off in the low-pressure cylinder at $1 \div 2.3 = 0.435$ of the stroke, it follows that to equalize the work in the two cylinders at the earlier cut off the receiver pressure would have to be higher than the pressure at the end of the expansion in the high-pressure cylinder.

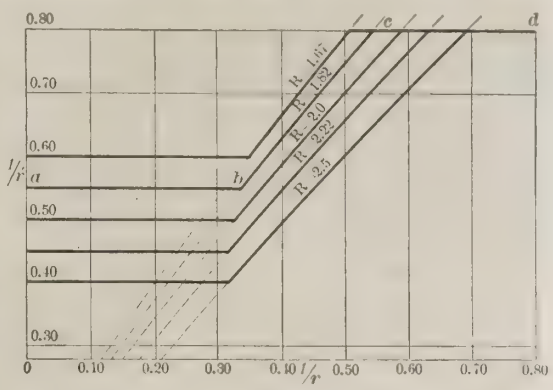


Fig. 41

The engineers of the Paris, Lyons & Mediterranean Railway have applied a formula similar to the above in the determination of the proportions for a class of four-cylinder compound locomotives, and have shown the proper relations existing between the points of cut-off in the high and low pressure cylinders graphically by a diagram similar to Fig. 41. This diagram is reduced from that given in a pamphlet by Mr. C. Baudry, assistant engineer-in-chief of motive power and equipment. Formulas similar to the above will be found discussed at greater length in "Compound Engines," by Mr. Mallet; but in some editions of his book there are many confusing typographical errors. In Fig. 41 the horizontal distances represent the points of cut-off in the high-pressure cylinder, and the vertical distances represent the points of cut-off in the low-pressure cylinder. The inclined lines are curves which represent the solution of equation (4) for different values of R, the pressures used in the construction of the diagram probably being 213 and 21 pounds. For example, if $R = 2.5$ when the high-pressure cut-off is at 0.4, the low-pressure cut-off should be at about 0.5 in order to equalize the work. If the ratio $R = 2$ a cut-off at 0.4, in the high-pressure requires a cut-off at about 0.58 in the low-pressure cylinder. For the cases in which the equation gives values of r' which are too small, the cut-off for the low-pressure cylinder is fixed at 0.8 or the maximum for full gear. For instance, taking $R = 2$, the low-pressure cut-off would remain at 0.8, or full gear for all values of the high-pressure cut-off greater than 0.58, although more than one-half of the work would then be done in the low-pressure cylinder. The other limit to the application of the formula is fixed by making the earliest low-pressure cut-off that at which there will be no drop in pressure between the cylinders. So that finally, the relation between the points of cut-off in the two cylinders is shown by broken lines such as $a\ b$ $c\ d$, for which $R = 1.82$. For example, if $R = 2$, the diagram shows that the points of cut-off should vary as follows:

High-pressure	.10	.20	.30	.40	.50	.60	.70	.80
Low-pressure	.50	.50	.50	.58	.70	.80	.80	.80

It does not of course follow that it will be advisable in practice to make use of the early cut-offs given above for the high-pressure cylinder, and it will be remembered that Mr. von Borries has stated, as the result of his experience with two-cylinder compound locomotives, that the most advantageous points of cut-off in the high-pressure cylinder are from 0.3 to 0.4 of the stroke.

Before calling attention to some of the special problems which will present themselves in the design of four-cylinder compound locomotives, illustrations will be given of three experimental types which have recently been constructed by the Paris, Lyons & Mediterranean Railway, and which are described in the pamphlet by Mr. Baudry, to which reference has been made. Fig. 42 shows the general arrangement of the compound locomotives intended for fast passenger service. The principal dimensions of these locomotives, and of the type of simple locomotive which formed the basis for the design, are given in the accompanying table under the heading, Fig. 42. The table shows that two compound locomotives of this and of each of the succeeding types have been built, which differ only in the number and diameter of the tubes. It will be seen that in the type of locomotive illustrated by Fig. 42 all four cylinders are placed beneath the smokebox, with their axes horizontal. The two high-pressure cylinders are between the frames and are connected to the forward driving axle. The low-pressure cylinders are connected to the rear driving axle. The axles are so coupled that the high-pressure crank on each side leads the low-pressure crank on the same side 198°. The object of this arrangement is to obtain as large a value for the minimum starting power as possible. In Fig. 43 is shown the general arrangement of the four-cylinder compound locomotives for freight service. In this locomotive the second driving axle is connected to the low-pressure cylinders, and the third axle to the high-pressure cylinders. The high-pressure crank on each side leads the low-pressure crank 232 48'. In the corresponding simple locomotive, of which the dimensions are given in the sixth column of the table, the rear axle is not a driving axle. Fig. 44 illustrates the a rangement adopted for locomotives for steep grades. The high-pressure cylinders are connected to the second axle, and the low-pressure cylinders to the third axle. The high-pressure cranks lead

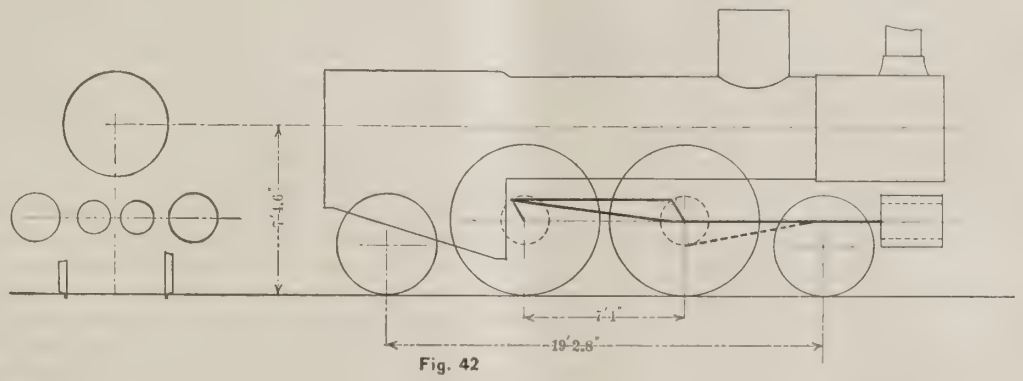


Fig. 42

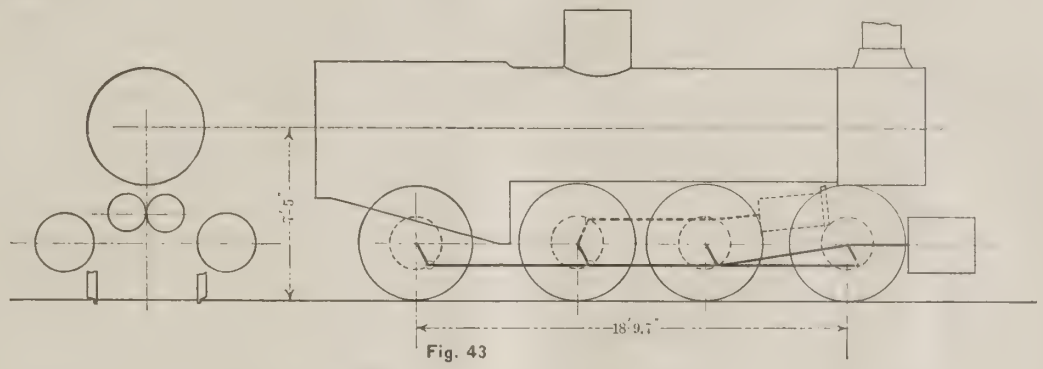


Fig. 43

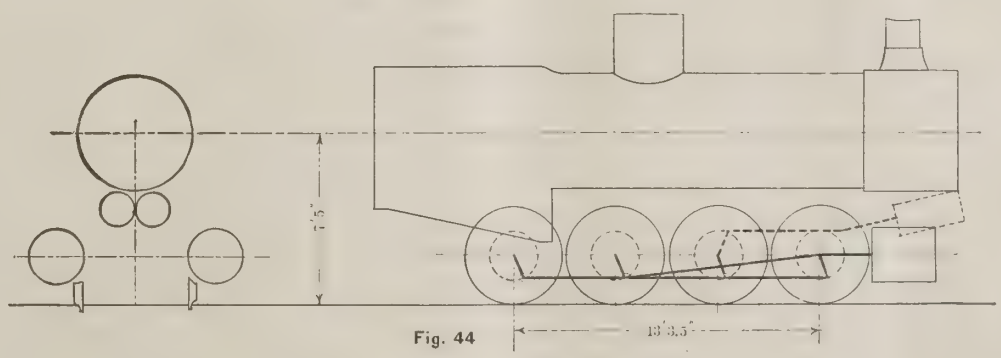


Fig. 44

*Copyright, 1889, by Arthur T. Woods.

the adjacent low-pressure cranks, as in the other designs, but in this case the angle is 235° 54′.

The Walschaert valve gear is used for all of these locomotives, and the points of cut-off in the high and low-pressure cylinders are adjusted by means of a complicated cam arrangement, designed to fulfill the requirements indicated by Fig. 41. The starting gear adopted for these locomotives consists of simply an auxiliary steam pipe and cock for admitting steam from the boiler to the receiver, which is fitted with a safety valve as usual. In determining the sizes of the cylinders the basis of calculation appears to have been the weight of steam which the boiler may be expected to produce without being forced. This quantity had been found by previous tests to be about 14,500 pounds per hour for the boiler of the express locomotive, and the cylinders should be capable of disposing of this weight of steam. Mr. Baudry states that the steam may, with due regard to the tractive power necessary, be expanded to a pressure of about 44 pounds absolute at a speed of 31 miles per hour, and to about 19 pounds absolute at a speed of 68 miles per hour. The high-pressure cylinders should be capable of utilizing the above weight of steam at slow speeds when the full tractive power of the locomotive is required and also at high speeds. The dimensions selected for the cylinders are thought to meet these requirements, the cut-off in the high-pressure cylinders being of course made earlier as the speed is increased. The method by which the angles between the adjacent high and low-pressure cranks were determined is not explained. Considering the question of balancing the locomotive, the best results would apparently be obtained by placing each high-pressure crank at 180° from the adjacent low-pressure crank. To obtain the greatest value for the minimum turning moment in starting the angle between the high and low pressure cranks should be 225°, assuming that the pressure of the steam admitted directly to the receiver is such that the total pressure on each piston is the same, and that the cranks on each axle are at right angles. The angles which were adopted appear to be to a certain extent a compromise. For the express locomotive, Fig. 42, in which the question of the balancing of the reciprocating parts at high speeds would be of most importance, the angle selected, 198°, is approximately half way between 90° and 225°. For the freight locomotive the starting power was apparently given greater weight in the problem, the angles in each design being 225° *plus* the angle of inclination of the high-pressure cylinders.

It will be interesting in this connection to note the reasons as given by Mr. Baudry for the adoption of such high steam pressures and the four-cylinder type. "The sole object of the study of new types has been to secure as great economy in fuel as possible. It has therefore seemed necessary to increase the boiler pressure considerably and to adopt the compound system. It is true that some saving in fuel can be realized by the use of the compound system without increase of pressure; but the ultimate advantage seems to be in this case at least questionable. With the pressures of from 128 to 156 pounds per square inch used for locomotives, it is not necessary to resort to this system to obtain a large expansion. Its adoption could then only diminish to some extent the losses resulting from condensation in the cylinders; but as the difference between the extreme temperatures is not very great, and considering the high piston speed, the economy which would result does not seem to be sufficient to compensate for the mechanical complication and the additional expense for repairs which it entails. With high pressures, on the contrary, a little more coal is required to heat the steam, but the possible work of this steam when suitably expanded is increased in a much larger proportion; but the expansion can no longer be accomplished in a single cylinder with slide-valve distribution, the only method which seems to be practicable for locomotives; moreover, the variations in temperature are much greater, and the effect of condensation in the cylinder may become considerable. For these two reasons the compound system becomes a direct consequence of high-pressures in locomotives. It was thus that Mr. Henry was led, without any other reason, to adopt for the new P. L. M. engines the pressure of 213 pounds and the compound system. . . . The employment of four cylinders is not a necessary consequence of the adoption of the compound system. Indeed, the greater part of existing compound locomotives in France and in other countries belong to the Mallet system, and have consequently only two cylinders. But the adoption of this system for locomotives as powerful as those under consideration would have led to very large dimensions, both for the cylinders and for their connections. With four cylinders, acting two by two on different axles, these dimensions are more moderate; there is the further advantage of perfect symmetry, and what is still more important, a notable diminution in the strains on the driving axles and on the track. The axles are less strained because each transmits but one-half of the work of the locomotive; and the strains on the track are less since the rapid shocks due to the obliquity of the connecting rods are proportional to the efforts transmitted by the latter, and since these are one-half less when the same work is transmitted by four connecting rods instead of by two."

We are indebted to the engineers of the Paris, Lyons & Mediterranean Railway for their very thorough investigation of four-cylinder receiver compound locomotives, and the report on the performance of these locomotives will be awaited with interest. But the writer is not prepared to admit that all of the points in Mr. Baudry's argument are well taken, or that the advisability of using the four-cylinder receiver type of engine has been demonstrated. A reference to the accompanying table shows that the weights of the compound locomotives are in all cases considerably greater than those of the corresponding simple engines, and they should therefore be more powerful, as they are in fact reported to be. But it does not appear that it was necessary to resort to this type of compound locomotive in order to secure the advantages of compound working. The adhesion weight and the diameter of the driving wheels of the compound express locomotive (Fig. 42) are nearly the same as in the Webb engine and in the Worsdell engine, which have been illustrated in these pages. The total weight of the four-cylinder locomotive is from nine to ten tons greater than that of the two and three cylinder locomotives, and there is, therefore, that much more dead weight. In the designs for the freight locomotives there is more reason for the use of four cylinders, although the three-cylinder compound locomotive of the Northern Railway of France, which we have illustrated, is comparable with the simple locomotive of which the dimensions are given in the sixth column of the table. It certainly cannot be justly claimed that the necessary complication of two-cylinder compound locomotives of the von Borries, Worsdell, or Lindner types, is sufficient to have much weight as an argument against their use. Nor does it follow that pressures as high as 213 pounds per square inch are a necessity in order to secure good results from the use of the compound system. We have no experimental data by which the advisable maximum and minimum steam pressures can be determined, but we have reports of good economical results from two-cylinder compounds working with a steam pressure of but 120 pounds. The economical advantages of compound working are in general more marked as the pressure is increased, but there is obviously a limit beyond which there will be no gain in economy by increasing the pressure. The reasons for this are similar to those which make the adoption of the compound system advisable in any case; briefly, that to secure the advantages of high-pressure steam it must be sufficiently expanded. Therefore, as pressures are increased, a point will be reached beyond which no greater proportion of the energy in the fuel can be utilized with two cylinders of practicable dimensions than can be utilized in a single cylinder with lower pressures. To secure full advantage of the high pressures, triple or quadruple expansion engines must be used as in modern marine practice. It is not, of course, to be inferred that it is advisable to construct triple or quadruple expansion locomotives, although such construction would seem to be more sensible than that of some of the ingenious monstrosities which appear perennially, and which frequently receive the favorable indorsement of men who should know better. We are not prepared to assert that such pressures as 213 pounds per square inch are too high for good work in compound locomotives, but wish simply to call attention to the fact that there are both maximum and minimum limits to the pressures which are properly applicable to compound engines.

The principal advantages of the four cylinder receiver type of compound locomotives appear to be the possibility of obtaining a very uniform turning moment, together with a better running balance than is possible with any other form of locomotive. Whether or not these advantages are sufficient to compensate for the greatly increased number of parts must remain a matter of opinion.

Mr. Mallet's "articulated" four-cylinder compound locomotives do not present any special features as far as the steam distribution is concerned. In this form the high-pressure cylinders are fastened to the rear part of the main frames, and drive one set of driving wheels, and the low-pressure cylinders are mounted on a front bogie with a second set of driving wheels. There is, therefore, no dead weight, and the locomotive is specially adapted for use on very sharp curves. At the same time, as the low-pressure cylinders are on the bogie, the joints in the steam connections are not subjected to high pressure and therefore will not be difficult to keep tight. This system has been used with success on narrow gauge roads, while on the other hand it has been adopted for a locomotive for the St. Gothard Railway, which weighs about 85 tons (2,240 pounds) in working order. There are six axles, coupled in two independent groups, the low-pressure cylinders being placed with three axles on the front bogie, while the high-pressure cylinders are fastened to the main frames and are connected with the other three axles.

DIMENSIONS OF FRENCH FOUR-CYLINDER COMPOUND AND SIMPLE LOCOMOTIVES.

	Fig. 42.			Fig. 43.			Fig. 44.		
	Compound.		Simple	Compound.		Simple	Compound.		Simple
	H. P.	L. P.		H. P.	L. P.		H. P.	L. P.	
Number of cylinders	2	2	2	2	2	2	2	2	2
Diameter of cylinders, inches	12.21	19.68	19.68	13.38	21.26	21.26	14.17	21.26	21.26
Stroke of pistons, inches	24.41	24.41	24.41	25.59	25.59	25.59	25.59	25.59	25.98
Inclination of cylinders	0°	0°	0°	7°48′	0°	0°	10°54′	0°	0°
Maximum travel of valve, inches	4.57	5.59	4.86	5.40	5.63	4.82	5.55	5.63	5.51
Outside lap of valve, inches, front	1.10	1.06	1.22	1 10	1.14	1.10	1.14	1.14	1.14
Outside lap of valve, inches, back	1.02	.95							
Inside lap of valves, inches	0	0	0.04	0.04	0.04	0.04	0.04	0.04	0.02
Maximum admission, per cent. of stroke	71.5	84.5	69.2	76.6	77.9	74.4	77.6	79.3	80.3
Steam ports, area, square inches	10.85	21.7	16.08	13.95	25.11	16.08	14.26	25.11	25.11
Steam ports, per cent. of piston area	9.35	7.13	5.35	10.13	7.09	4.59	9.04	7.09	7.09
	(1)	(2)		(1)	(2)		(1)	(2)	
Number of tubes	185	224	185	247	307	200	247	210	245
Diameter of tubes, outside, inches	1.97	1.77	1.97	1.77	1.58	1.97	1.97	2.17	1.97
Length between tube sheets, feet	13.24	13.24	16.23	14.28	14.28	16.49	13.62	13.62	17.57
Heating surface, fire-box, square feet	125.1	125.1	113.	112.7	112.8	112.3	117.9	117.7	104.5
Heating surface, tubes, square feet	1161.4	1252.6	1422.7	1489.	1643.	1549.	1579.	1491.	2024.3
Heating surface, total, square feet	1286.5	1377.7	1535.7	1601.7	1755.8	1661.3	1696.9	1668.7	2128.8
Diameter of boiler inside largest ring, inches	49.6		49.7	55.1		55.1	59.1		59.1
Area of grate, square feet	25.2		24.1	25.5		23.9	23.5		22.4
Diameter of driving wheels, inches	78.74		78.74	59.06		59.06	49.6		49.6
Weight in working order on driving wheels, pounds	65,260		62,940	125,450		93,120	125,890		120,300
Weight in working order, total, pounds	117,950		111,340	125,450		114,060	125,890		120,300
Ratio of l. p. to h. p. cylinder	2.6		....	2.52		....	2.25		....
Ratio of receiver volume to one h. p. cylinder	5.58		....	4.24		....	3.79		....
Boiler pressure, gauge, pounds per square inch	213.3		156.4	213.3		142.2	213.3		156.4

A remarkable story of a railroad accident comes from Japan. The *Japan Gazette* states that on Jan. 24 a soldier committed suicide by throwing himself in front of a train on the Tokaido Railway. When the body was found one of the arms was missing, and, on arrival of the train at Kobe, the missing limb was found attached to one of the engine wheels. The distance between the spot where the suicide took place and Kobe is about 200 miles.

The J. G. Brill Company, builders of cable and other railway and railroad cars, are putting up extensive works at Sixtieth street and Woodland avenue, with a view to removal from their present quarters at Thirty-first and Chestnut streets, Philadelphia, which have been found inconvenient and inadequate for their present business, and without the necessary railway facilities. The new situation is said to be admirably adapted for carrying on their increasing business. It has a frontage of 1,100 feet on the Philadelphia, Wilmington & Baltimore Railroad, and a depth of 350 feet, the northern end adjoining yards and roundhouse of the Baltimore & Ohio Railroad, with tracks connecting the works with both railroads, the entire plot containing 18 acres. Mount Moriah Station is at the southern end and Sixtieth street station at the northern. The firm expect to give employment to 750 men, and now have nearly 600 on the roll. They are their own architects and contractors, and expect to have the works entirely completed and in running order by May 1. The J. G. Brill Company was started by J. G. Brill and G. M. Brill in 1868, and in 1872 James Rawle was associated as a partner. It was incorporated in February, 1887, with a capital of $300,000. The officers are: President, G. Martin Brill; vice-president, John G. Brill; secretary and treasurer, James Rawle. Henry Rawle, ex-State Treasurer, is one of the directors.—*Railway World.*

The Strong Locomotive Company inform us that they intend building works near Cincinnati, and that contracts will be let within six weeks to one of the large bridge-building companies for the iron work. An officer of the company writes: The brick will be made on the ground, and the stone will be quarried out of the hills on the property we have acquired, which consists of about 1,350 acres, located about 15 miles from the heart of the city up the Mill Creek Valley, where we have the Cincinnati, Hamilton & Dayton, the Cleveland, Cincinnati, Chicago & St. Louis, and the Pennsylvania lines, and also the Erie, which passes over the Big Four system at this point. These lines will all be connected by a track extending across our property, which will give us the best of railroad facilities, and Cincinnati rates on all material coming and going from any point on any one of these lines and their connecting lines, which, as you will understand, gives us the entire United States: We have arranged for Cincinnati switching rates on all cars loaded in Cincinnati, which practically places us in Cincinnati, as far as river rates are concerned, giving us a very low price for fuel and cheap iron, and this, as you are aware, is a good labor market, the best to be found west of Philadelphia. We propose making use of the most improved appliances in every department of the works, and shall introduce many new and novel methods in forging, milling, gang-drilling, etc., so as to produce the greatest quantity from the least possible cost, and to maintain a high standard of excellence,

Communications.

Joint Car Inspection.

Editor National Car and Locomotive Builder:

Joint inspection is one of the leading questions in railway operation to-day. One of the railway clubs has taken it up for discussion, as to which is the best system for inspection at interchange points. At your request I will undertake to give you my views thereon. Having had considerable experience in the organization and operation of the two leading systems of joint inspection, I am able to speak from that knowledge.

DETAILS OF THE BUFFALO PLAN.

There are two plans that are worthy of attention, one is the so-called Buffalo plan, the other the Detroit plan. The former has been in practice some eight or ten years quite successfully, and has been very extensively copied. It is worked in this way: The chief joint inspector is engaged and paid by the companies interested. He is given full control of the inspectors and inspection of all freight cars offered for interchange. He is amenable only to the heads of the car departments combined. If an order is given him by any one road, it must first be approved by all the other roads party to the contract, otherwise the joint inspector need not recognize the order. Two or more inspectors are placed in each yard; their duties are to inspect all freight cars on arrival and before delivery to connecting road. Cars found with defects are switched out and placed on repair track. If defect is too bad to repair under load it is transferred, which should be at expense of delivering road (at some points the expense of transferring is borne jointly by delivering and receiving roads). The inspectors are changed from one yard to another periodically, which prevents to a degree any chance for favoritism. As a rule they are not supposed to do any other than the work pertaining to joint inspection. Generally, after the first inspection, the joint system is done; no difference how far the cars may have to go to be delivered to receiving road, the latter has no check against the delivering road for defects that may have been overlooked or made in the delivery unless they can make it all right with the joint inspector. If the officer of the receiving road wants to be sure that his trains are O. K. before sending them out, he must do the final inspecting at his own expense; he has no direct control over the joint inspectors. At some points an order may be given by joint inspector on delivering road to do the repairs that may have been overlooked, or done in transit from one road to the other, and bill delivering road for same, but this is an exception. The cost for maintenance of this method of joint inspection per month, is, say for a five-road interchange, about as follows: One chief joint inspector, $100; twenty-two (22) inspectors, $50 each; one clerk, $60; office expenses, fuel, light, stationery, etc., $240; total, $1,500, or $300 per road.

THE DETROIT PLAN.

The other, or Detroit plan, has been in use about six years. It differs from the former plan very materially, and in that differing is where it is considered an improvement. As this system is not so well known as the other, it might be as well to describe it more in detail.

The chief joint inspector or arbitrator is controlled the same as in the other system. He decides all disputes arising between the roads interested, and sees that the inspection in the different yards is uniformly and properly done. He deals directly with the car foreman in each yard, having no direct control of the inspectors. Each railway company maintains its own inspectors in their own yard, who are under the direct control of the car foreman of such yard; the number employed is the same as in the former system. Their duties differ somewhat from the other, as they inspect all cars inbound, no difference whether for interchange, local or city freight; also all cars outbound before leaving, thereby insuring the greatest degree of safety. The latter is necessary in many cases on account of the long distance between delivering and receiving yards, and the liability to damage in switching. Repairs that can be done at once are, as a rule, done by the inspectors. One of the best features of this system is the check the second inspection gives the receiving road against the delivering road from defects overlooked or neglected in the first inspection. Such repairs are done at once by receiving road, and the joint inspector's attention called to it, who gives an order on delivering road for charges. It may be thought that the first or self-inspection will be done carelessly, allowing defects to pass for receiving road to repair. As a check against any such movement the joint inspector's order to charge repairs against delivering road is quite sufficient. As it is to the interest of each car foreman to keep the charges down to a minimum, he is not very likely to permit any neglect on the part of his men, therefore, a close inspection is insured on both sides. The joint inspector only is authorized to give orders to transfer loads from defective cars, and to issue interchange "defect pass cards." The cost for maintenance of this system is low, as the chief joint inspector's salary (say $100), is all that is charged, which with five roads would be only $20 per month. The joint inspector has no clerk or office expenses. He uses the car foreman's offices to do any such work, as the car inspectors are under and maintained by the road in whose yard they work. In addition to the interchange inspection they do the local or any other inspection, and when not engaged at inspecting they are used on light repairs, which very materially facilitates the prompt movement of freight. Although there are no more men used in each yard, they do both the in and out-bound, as well as all local inspection, and a large amount of light repairs. In the first system they only do the in-bound inspection. All out-bound and local inspection and light repairs are done by additional men, this, of course, at a considerable additional cost.

We hear continual complaints from the traffic and freight departments of delays to freight, which is charged to car departments. As a rule, these charges go up to the management very often, and then the head of the car department is called up for the reason of all these complaints, and why an improvement cannot be made. Is it not quite evident that the car departments generally are somewhat slow to take advantage of the best means in their favor? Joint inspection is certainly a panacea for the complaint, and should without doubt be applied at all interchange points, from the two-road junction to the largest railway center. Without question, if joint inspection were applied as a cure for the troubles complained of, they would be reduced to a minimum. A fair trial is the test, as has been proven. In the last system described not a complaint has been made. System and order prevails. Hence there is no advantage taken, all the roads interested working as one body and in harmony, and the promptness and dispatch with which freight is handled is remarkable.

PROGRESSIONIST.

Cost of American and English Locomotives.

ZAPIZA, March 19, 1890.

Editor National Car and Locomotive Builder:

I have heard some pretty harsh comments on your article in February number, viz.: "Cost of American and English Locomotives." Even to the extent of saying "it is all rot. That you ought to be more careful what you print," etc.

These comments are chiefly on the statement made that in an English shop employing 2,500 workmen 200 engines were built last year, while an American shop employing 1,400 men built 300.

I hope some of your readers who have had opportunities of posting themselves on both sides will (as you suggest) give us their views and reasons for this difference in production of engines, or if no objection to doing so, could you name the shops alluded to? "R."

[The statement alluded to in this letter was perfectly correct, although we do not feel at liberty to publish the names of the locomotive builders. We will, however, be glad to give the names privately to any of our readers who doubt the truth of what has been said about the relative output of American and British locomotive works.—ED.]

Slip of Driving Wheels.

Editor National Car and Locomotive Builder:

I noticed your reply to the query, "Why will an engine slip her driving wheels when running down hill with steam shut off" in the March number. However true your answer may be in the experience of others, I have never seen a case but could be attributed directly to imperfect quartering of one pair of driving wheels, which may be caused by a bent crank-pin, twisted axle or any cause whereby one pair of cranks do not follow the others without undue strain on the side-rods. This slipping always ceased when this defect was remedied, regardless of counterbalancing.

GIBSON.

The Mackey Order about Punctuality.

Editor National Car and Locomotive Builder:

On page 61 of the April number of your journal you make some very caustic and objectionable remarks respecting an order issued by President Mackey calling for more faithful and punctual service from certain employés of the system of which he is the chief officer. It appears to me that your remarks are calculated to inspire feelings of disloyalty against this and other managements, and as I understand the matter this is contrary to the declared mission of such publications as yours. The offending order called for strict attention to business on the part of those who ought to set an example to men in the lower grades of the railroad service, and such an order ought to receive the cordial support of all publications having the best interests of railroad men at heart. Many of the officers and others to whom the order applied perform their duties zealously, and they required no urging to faithful performance of the work they are paid for doing; but others again need the spur all the time, and such men by the order get plain intimation that neglect of business will not be tolerated.

On all sides restrictions are being put upon railroad companies, and their just rights so unscrupulously infringed that it is with the greatest difficulty managers can obtain revenue to pay operating expenses and fixed charges. Under these circumstances it is the bounden duty of managers to use every fair means at their disposal to obtain the very best service from all employés. The right place to begin is with the men carrying on the work, for if they are slack and careless those under them may be depended upon to do no more work than they can help. In a great railroad system one hour a day idled away by an army of employés means the difference in operating expenses that would save a struggling corporation from the hands of a receiver. A small portion of the men affected may consider themselves aggrieved by an order to be ready to commence work at the proper hour, and the men who are most aggrieved are those who would display the least forbearance if the paymaster should not reach them at the regular day. The men who make their mark in the railroad and financial world have to work early and late. They do this because they have good sense, and understand that industry will bring its reward in the end. When men are so short-sighted that they cannot perceive that in such conduct lies their true interests, they have no good reason for complaining that those above them feel constrained to remind them of a patent duty.

OBSERVER.

[We have commented on this letter on our editorial page.—ED.]

The Best Way to Handle a Locomotive.

Editor National Car and Locomotive Builder:

Having seen from time to time various articles on above subject in your valuable columns, and having been a locomotive runner for the past 10 years, both American and English built engines, I would feel obliged if you would grant me space for the following few remarks:

Firstly, the great consideration to be aimed at is to accomplish the greatest amount of work at the least possible expense, and this I have always found, both as regards coal bill and repairs, to be accomplished in the following manner. The whole principle lies in the management of the lever and throttle valve. For instance, a train should be started with the lever out and steam throttled, gradually hooking lever up and opening throttle, the throttle being opened only as far as compatible with speed to be attained, as with a light train and full throttle a locomotive would run away. Those, of course, are minor details and must be left to a runner's judgment.

The great point, however, to be aimed at, and the one to which I would more especially direct attention of locomotive runners, is, that the most economical and therefore the correct method of handling a locomotive, is a full throttle and the lever hooked up, that is, the shortest cut-off possible to be got.

The reason for this is that the steam admitted to the cylinders at almost boiler pressure is at that pressure more expansive, and therefore a great deal less steam does the amount of work; hence we have a saving of steam.

In the throttling system the steam is admitted to the cylinder at less pressure, consequently lower temperature, and therefore less expansive. It will, therefore, I think at once be seen that under this system a greater amount of steam will be required to do the same work.

Again, as regards notching lever up in getting away with the train, the lead is increased, consequently the engine is getting more freedom and will gain speed quicker, owing to the fact that steam is cut off earlier in the stroke. This steam expands, and when the exhaust port is opened the steam is, comparatively speaking, at a very low pressure, and releases itself more freely and completely, thus doing away, or rather reducing, back pressure to a minimum.

If an engine is rushed at the start no doubt she gets away quicker up to a certain speed, but at that speed she remains, and with the result of the fire being damaged and no benefit whatever accruing.

Now, on the other hand, if a runner at the commencement gives his engine a few sharp blasts sufficient to put his fire into a good state of combustion, and then hooks her well up into the expansion, he will maintain his superiority both as regards economy and speed over the man who works his engine *vice versa*.

An idea that is prevalent among many men is, that a full throttle is an incentive to foaming, but this is an error, dirty boiler, of course, being excepted. It is one of those notions propagated by our ancestors, and, like many of their ideas, has been proved erroneous.

To my idea, and I venture to say to that of a large majority, a full throttle simply means an extension of boiler space, the slide valves acting as a regulator for admission of steam to cylinders; in fact, these valves are the governors of the power, and I maintain that when once a throttle is opened it can, so to speak, be looked upon as a sort of nonentity.

Now, as regards the feed, the more regular the more economical, because when the feed is irregular or worked in fits and starts, the temperature, and consequently the pressures are continually varying. Add to this the fact that the ratio of expansion follows suit with the temperature, the damage to boiler plates, tube plates, stays, etc. from any irregular mode of feeding must be very great. This proves, I think, that the more even a pressure is maintained the far more economical results accrue. Of course, in the consummation of these remarks, the quality of fuel must be looked into, as where the fuel is of the best quality it is easier to maintain an even pressure. As regards a fireman keeping a gauge at uniform pressure, I must not forget to mention that a great deal to do with this is the way in which the engine is handled by the runner. The engine should not

be worked by fits and starts any more than the boiler fed by fits and starts. Regularity in all things in connection with a locomotive should be the order of the day from start to finish. In conclusion, sir, I would inform you that on these, the New Zealand, railways, a man who does not work his engine expansively is, I think, a *rara avis.* Thanking you for publishing these few remarks in your journal, which is unanimously voted here a most instructive one,

GEO. BOWLES,
Secretary and Treasurer Locomotive Technical Library, and Engine Runner, New Zealand Railway, Invercargill.

Payment of Sleeping Car Mileage in Europe.

Editor National Car and Locomotive Builder:

Referring myself to the third annual report of the Interstate Commerce Commissioners in regard to "Sleeping Cars Impoverish Railroad Companies in America," on this subject I must say the thing is quite different with us in Europe.

If the car mileage is paid by railroad companies for the use of sleeping cars with you, here the sleeping cars have to pay the mileage to the railway companies besides the 50 per cent. on the fares, and instead of impoverishing the railway companies they grow fat on this special service.

Of course this system burdens the public with high rates for the use of the sleeping cars, which varies according to routes from $4 per night up as far as $25 per night, but on the contrary to the United States, the public is not subjected to inferior accommodation in ordinary coaches.

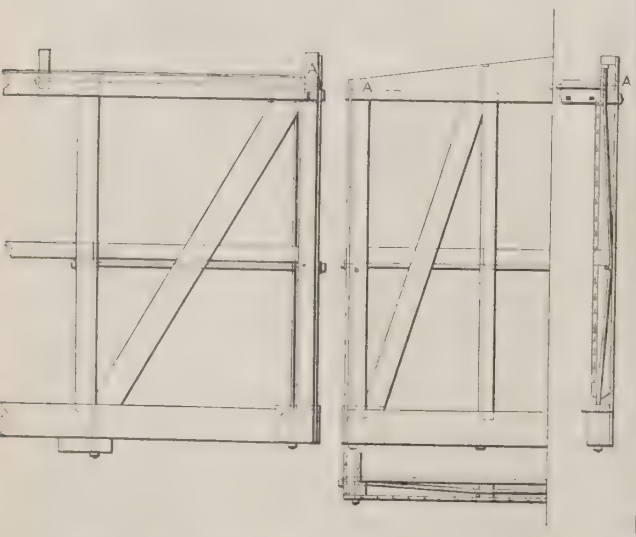
Although great improvements have been made in the style of coaches in Italy, especially in the first and second-class cars, so far they have not absorbed the bulk of the travel, and we see customers use the sleeping cars repeatedly three and four times per week, although these cars on the Mann boudoir system do not meet the comfort of your cars in America.

The public in general in Europe prefer paying high rates for special accommodation, and in the meantime the provision of this superior accommodation does not become a charge upon the general transportation, but on the public itself.

EDWARD J. SCHEMBRI.
Campagnie Internationale des Wagons-lits, Torina, Italia.

Method of Strengthening Box Car Ends.

Referring to the subject of "strengthening box car ends," Mr. J. D. McIlwain writes that the attached plan in some respects has been in use for several years, and has proved very effective. This plan embodies all the principles shown in March NATIONAL CAR AND LOCOMOTIVE BUILDER, with a number of additions. The end plate *A* is framed to the side plates. The end posts are 3½ inches square; end plate, 3½ inches thick; the tenons of end post are 1½ inches by 3½ inches, with 1½ inches outside shoulders; the ends are lined clear up. The advantage of this is when a car is loaded above the grain belt with loose freight, it prevents the breaking of the outside sheathing if the load is shifted, which often occurs. The end posts are trussed vertically with ¾-inch rods, grooved in flush with edge of post;



a cross rod under the girth acts as a truss, and ties the car crosswise. Neither of these rods interfere with the sheathing, which is the objectionable feature of the S. P. plan; a tie rod connects the corner post with the first side post, also a rod connects the end plate to first car line. At the top corners is a corner plate 3½ × ⅜ inches, and 12 inches long on each side of angle, bolted with four bolts to side and end plates. This corner plate projects ¾ inch below line of shoulder of corner post. The framing of upper corners in this way gives additional strength to corner post to resist end thrusts of the load. Both the top and bottom corner plates give strength to the ends by projecting below the plates and above the sills ¾ inch. These plates are fixed outside of sheathing.

The "Burlington Route" people have a handsome map of the United States, showing North and South Dakota, mounted and suitable for home or office use, which they furnish free to parties interested on application.

The Woebber Brothers car works, of Denver, secured the contract for twenty cars for the Pueblo Street Railway.

A large car factory is shortly to be established at Mount Vernon, Ind. The buildings vacated by the removal of the Louisville & Nashville shops are to be used by the new company, which is composed of local capitalists.

The Wagner Palace Car Company's shops, at East Buffalo, are crowded with work. Among the important contracts on hand are the building of eight parlor cars for the Vermont Central, two parlor cars and two sleeping cars for the Shore Line and a number of new cars for the limited trains on the New York Central and Lake Shore. During the past month the company increased its pay-roll over $5,000 a month. It is now employing over 1,000 hands.

Mr. Ward, master mechanic of the St. Paul & Duluth, has been preparing drawings and specifications of a standard box car for the Duluth & Winnepeg Railroad Company. The cars are intended to carry a load of 50,000 pounds, and will be built in first-class shape. They will be 34 feet long outside of end sills, 8 feet 6 inches wide outside of side sills and 7 feet 7 inches high from bottom of sill to top of plate. The cars will have the Winslow patent roof, Butler drawbar attachment, Janney coupler and National hollow brake beam. No power brake will be applied, but the arrangement of levers will conform to the Westinghouse Air-Brake Co.'s drawings. All other attachments will be first-class in design, material and workmanship.

Illinois Central Cars.

The Illinois Central are getting some new standard coaches built at Pullman. They are finished in mahogany inside and have quartered oak ceiling. The upholstering is crimson plush and the seats Hale & Kilburn. There are two saloons in each car and two washstands. A Baker heater is used, with about 350 feet of 1¼-inch piping distributed under the seats. Four Adams & Westlake chandeliers are used for lighting each car. Ventilation is secured by the deck and transom sashes swinging with Morgan's ratchet and two globe ventilators. The window blinds are mahogany, with basswood seats. Over each washstand a handsome plate glass mirror is set. The outside painting is yellow, with very little ornamentation. The coaches are carried on 4-wheel trucks, the wheels being Washburn double-plate 36 inches diameter. The axles used are the large M. C. B. standard. They are equipped with the quick-acting Westinghouse air brake.

A lot of suburban cars that are under construction for the same company are substantially the same as the day coaches, except that rattan seats are provided.

Excursion to the Carnegie Steel Works.

Messrs. Coolbaugh, McMunn & Pomeroy, special railway agents for Carnegie, Phipps & Co., lately gave an invitation to a number of railroad men and journalists to visit the works of Carnegie, Phipps & Co., at Pittsburgh, Pa. The party was taken to Pittsburgh on Thursday, April 17, by two special chartered Pullman cars, returning Friday evening the 18th. This was the second excursion under their auspices to visit the Homestead Steel Plate Mills; a description of the first was given in our last issue.

The trip was heartily enjoyed and commended by all participants as one full of instruction, and of great value to them. The following gentlemen were in the party:

G. D. W. Smith, P. A., Central R. R. of New Jersey; E. P. Sheffer, P. A., N. Y., L. E. & W.; R. H. Wilbur, Asst. to 2d Vice-Pres., Lehigh Valley; John Lentz, M. C. B., Lehigh Valley; L. B. Paxson, S. M. P., P. & R.; L. M. Butler, S. M. P., N. Y., P. & B.; A. W. Sumner, Asst. Pur. Agt., Penn.; J. H. Agnew, S. M. P., South Carolina; W. Gibbs, P. A., P. P. & B.; G. W. Gage, S. M. P., P. P. & B.; W. C. De Armond, P. A., Norfolk & Western; Albert Griggs, S. M. P., N. Y. & N. E.; A. S. Vogt, Mach. Eng'r., Penn.; Mr., Gillard, Asst. P. A., B. & O.; Col. Prout, *Railroad Gazette;* J. A. Hill, *Locomotive Engineer;* J. H. McGraw, *Journal R R. Appliances;* M. F. G. Ely, J. N. Lauder, S. M. P., Old Colony; J. W. Marden, Supt. Car Dept., Fitchburg; J. C. Glass, M. M. Alleghany Valley; H. D. Mason, Pur. Agt., Alleghany Valley; Abram Gould, Pur. Agt., Missouri Pacific; Wm. Garstang, S. M. P., Chesapeake & Ohio; W. E. Maher, Supt. M. P., C., C. & C.

The Damascus Bronze Company, of Pittsburgh, Pa., are very busy, it being necessary to work double time to keep up with their orders.

The Kansas City Switch and Frog Company have opened a branch office at Omaha, Neb., with Mr. Spencer Otis, a well-known mechanical engineer, as manager.

"The Westinghouse automatic brake is now in use on 20,000 engines and 240,000 cars. This includes 140,000 freight cars. Orders have been received for 80,000 of the improved quick action brakes since December, 1887."

Kansas City, Fort Scott & Memphis is improving its equipment in the passenger department. Mr. Nettleton has just issued orders for a number of new coaches, which will be furnished with the Scarritt reclining chair.

Messrs. Pedrick & Ayer, Philadelphia, have issued a circular illustrating the Richards open side planer and shaper. The machine is shown performing a great variety of operations that strikingly demonstrate the usefulness of the tool.

The Burlington, Cedar Rapids & Northern have placed an order with the Michigan Car Company, of Detroit, for 25 refrigerator cars, of the Standard Tiffany Refrigerator Car Company's patent, with Bosman tanks. These cars are to be 34 feet long, and of 50,000 pounds capacity, and are to be placed in the general service of this line.

The Buffalo Steam Forge, of Buffalo, N. Y., are busy turning out large numbers of axles, and to increase their facilities to keep up with their orders, have leased the Cayuta Forge and Axle Company's Works at Sayre, Pa., and are now prepared to furnish car and locomotive axles of any size and in any quantity. They are also prepared to furnish any kind of railway forgings, also wheels fitted to axles.

We have lately heard very favorable reports of the excellent work done by the Forstner auger bit manufactured by the Bridgeport Gun Implement Company, New York. The bit is formed of triangular cutters set on a disk, and they are noted for their smooth and rapid work. This form of bit received the highest award at the American Institute Fair, and it ought to be better known among car-builders.

The Ajax Lead Coating Company, 46 Richmond street, Philadelphia, Pa., have in their office some nails immersed in strong ammonia, but being coated with their lead coating do not show any signs of rust. They have also a piece of sheet iron coated with lead that has been in their yard for over a year, exposed to all kinds of weather, that is just as good as when first put out. They claim that by their method the iron, being chemically cleaned and properly annealed, and that the lead being alloyed with it, is greatly improved and its tensile strength increased.

On the 21st of March last a test was made on the Buffalo, Rochester & Pittsburgh Railroad in the presence of W. A. Baldwin, vice-president, and A. Dolbeer, superintendent of motive power, of a new pressed steel drawbar attachment made by the Schoen Manufacturing Company, of Philadelphia, Pa., as against the standard drawbar attachment, with the result that the former, being much stronger and lighter than the latter, was adopted for use on that road, an order for the equipment of 500 cars being given, also an order for 500 for the Beech Creek Railroad.

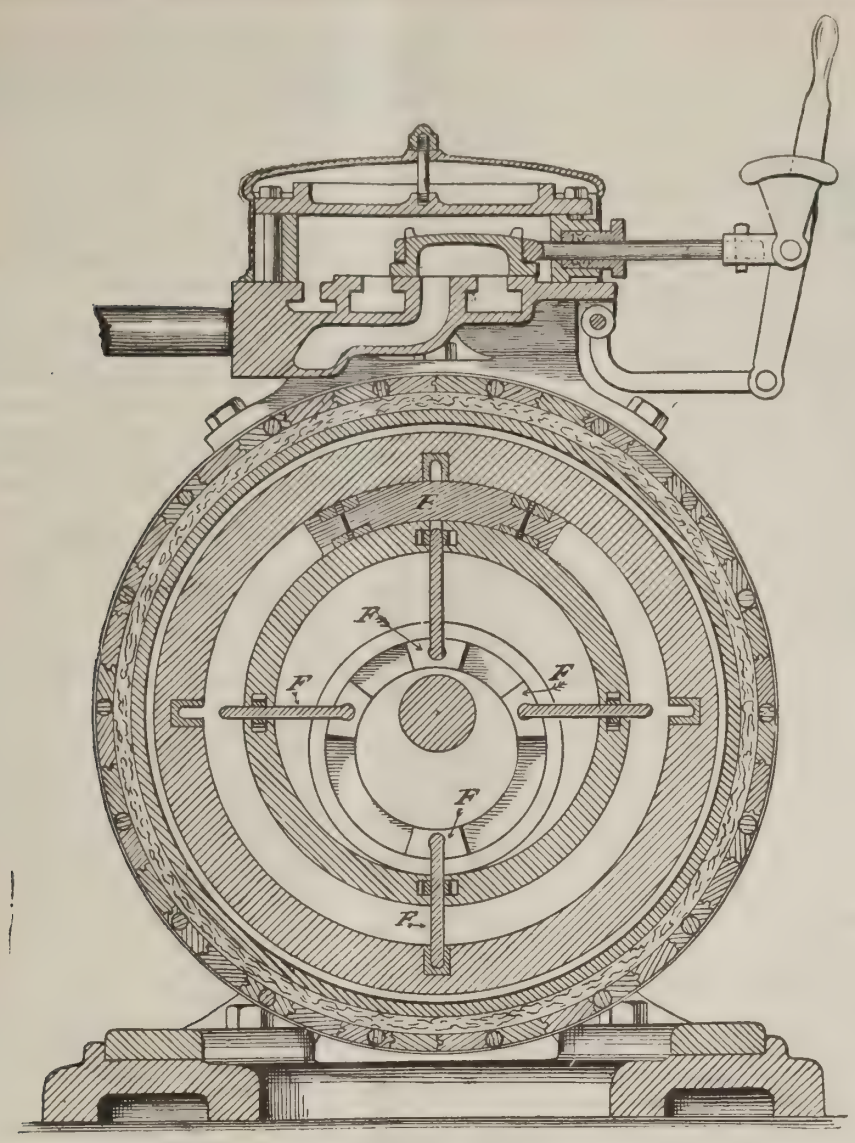
The Acme Machinery Company, of Cleveland, O., have published a neat illustrated catalogue showing their specialties. Their bolt cutters, bolt headers, nut tappers and other tools are clearly illustrated by perspective and sectional engravings. Parties interested in machinery of this class would do well to send for the catalogue.

The Acme Machinery Company, of Cleveland, Ohio, among the numerous orders recently received have one for a 4 inch acme bolt cutter with lead screw attachment for cutting a square thread cotton press screw of 1-inch pitch of thread, showing the adaptability of their bolt cutters to all classes of work.

A company is being organized in Pittsburgh, Pa., with a capital stock of $100,000, by Mr. W. T. Paul, manager of the Damascus Bronze Company, at the head, for the manufacture of the Smith oiler for car journal boxes, invented by Mr. W. O. Smith, of the Lake Shore & Michigan Southern Railroad. This oiler has been tested on a mail car on that road for the past two years, with a record of $\frac{1}{32}$ inch wear on the axle during a run of 32,123 miles, one ounce loss of brass on the journal bearing on a run of 22,100 miles, and one pint of black oil was sufficient for a run of 6,000 miles. No waste is used in this oiler, and it is so arranged that not a drop of oil can escape from the journal box. One fact worthy of notice is that during the two years that the oiler was in use on the mail car above mentioned there were no warm journals, and not a drop of oil was thrown on the wheels or the bottom of the car, thereby showing not only a great saving in the use of oil, but doing away with the liability of cars catching fire from being saturated with oil thrown out from journal boxes under the old method of lubricating.

About a year ago Pedrick & Ayer, manufacturers of milling machines and special tools for railway repair shops, moved into their large new shop, on Hamilton and Buttonwood streets, west of Tenth, Philadelphia. The building has a front on both streets of 40 feet and a depth of 160 feet, and is two stories high, and, although the structure was planned and erected with a view of adding more stories should the contingency arise, the firm say they did not expect that event for at least five years, yet before they were in it a year they found that, as they had secured the patent and manufacture of two new machines which are coming into use among railroad companies, and the unexpected increase in the general line of their business, the necessity for the enlargement of their building at once became necessary; therefore, a force of mechanics are at work putting two additional stories on it, thus doubling its capacity. New and improved tools are to be put in.

The old shop, on Hamilton street, a few doors west of their present location, has been retained as a repair shop, but upon the completion of the enlargement this branch will be removed to the new building, so that all the work may be under one general management. The drawing-room, which now occupies the western half of the second story, will be removed to a room double the size on the third floor, and the space thus vacated be thrown into the general office, which at present is too contracted for the growing business of the firm.



DUPLEX ROTARY ENGINE.

The accompanying cut represents an interior view of the duplex rotary engine, invented and patented by Messrs. Meyer, Kiehl & Grant, Chicago. The inside wheel represents the cylinder and the letter *E* the stationary abutment, which is the same as the head of the piston engine. The letter *F* represents the piston cut-off. These are operated by a stationary cam. This stationary cam moves the piston out and in under the stationary abutment. The steam chest on top of engine contains the slide valve, same as shown on cut, which is operated by a lever to start, reverse or stop engine, and also answers the purposes of an exhaust, under slide valve, as in an ordinary piston engine. The steam enters the engine on both sides alike, which equalizes the pressure. The inventors claim for the same an economy of steam. In this engine, as is demonstrated in cut, the steam entering through the port is confined in the steam chamber. This chamber being toward the outer end of the inside wheel, gives the steam a leverage which is an increase of power. The steam is carried entirely around in this chamber, and cut-off by the four pistons, giving it a clear distinct cut-off as in straight line piston engine. The engine is really the piston engine put in a rotary movement. In view of the fact that the electric power has come more in constant use, the demand for high-speed engines has been materially increased, and the best mechanical experts and engineers have conceded the fact that the rotary engine, on account of its continuous motion and steady pressure would be by far the best engine for all high-speed purposes. A vast number of rotary engines have been from time to time invented, which have proven failures because of the excessive consumption of steam and their liability to wear out soon. The obstacles are all overcome in the duplex rotary engine, the parts within being so compact that nothing can become displaced or disarranged. The construction of this engine is on entirely new principles, the inventors having discarded every feature that might lead into the beaten paths of others who have gone before.

There is no point in its design that cannot be fully indorsed, nor are there any engines of the class in which the strain and friction are so well resisted, the endurance of the working parts so well secured, and the power obtained in so direct and simple a manner. These engines will be built of various capacities ranging from one horse power to 1,000 and over, as may be desired. They can be adapted for all work where power is required for marine and stationary purposes. The motive power can be utilized by steam, water or compressed air. The leading engineers of Chicago and those from a distance, who have studied and carefully examined the working parts of the engine and the method of its application of power, pronounce it the best and most practical rotary engine ever invented and put into successful operation. One of the engines is doing successful work at the Exposition Building running an arc-electric dynamo. The engine would be admirably adapted for driving electric dynamos on railroad trains and for many purposes about railroad stations where the attention of a skillful engineer cannot be provided.

The Magnolia Anti-Friction Metal Co. is sending to its friends a romance entitled "Luxilla." It is a handsome book, and said to be very interesting. Any one who will send the company three cents for postage will receive a copy by return mail.

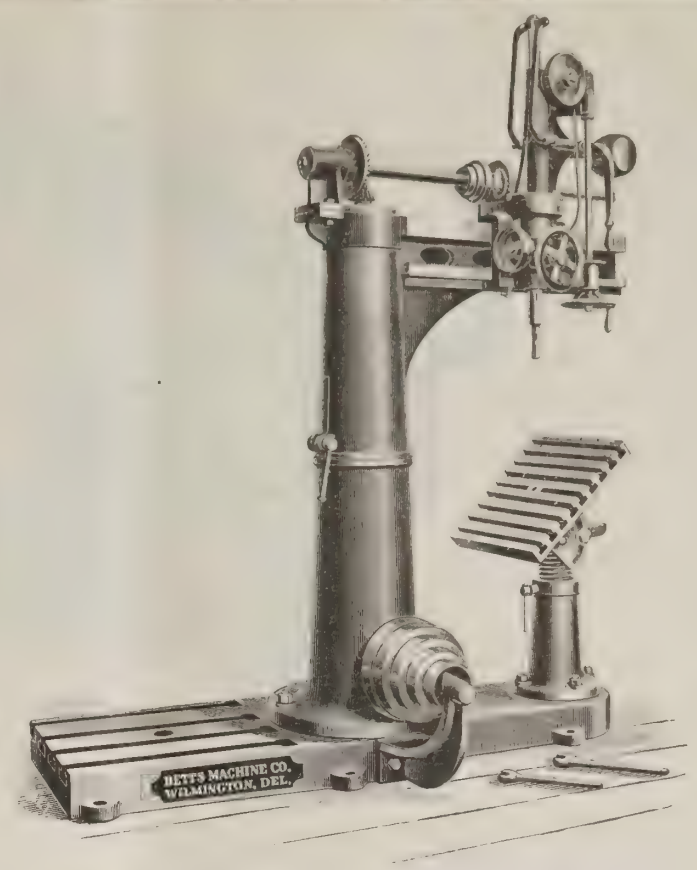
The Dunham Manufacturing Co. report constantly increasing orders for the Davies Locking Spike as these goods become better known by the railroads throughout the United States. Quite a large number of roads have recently placed orders for Globe Ventilators. The Servis Railroad Tie Plate is continually growing in favor with practical railroad men, and orders being received are correspondingly large. This company is now manufacturing a larger and heavier plate, with an extra flange in the center, for use on roads owning heavy rolling stock and hauling largest loads. These plates are giving excellent satisfaction, and are now going on many miles of new track, their economical value being recognized by contractors and progressive railroad men. The Dunham Door is not only being liberally supported by its many old patrons in the way of substantial orders, but a number of important new roads have recently been added to the large list of roads now using same.

The Tripp Manufacturing Company, of Boston, are at present engaged in building a double truck car for the West End Street Railway Company, of Boston. The car will have eight wheels, will be 28 feet long from door to door, 7 feet 3 inches wide, and 7 feet 9 inches in height from the floor, and will have seating capacity for 40 passengers. Each truck has four 30-inch steel wheels, and two 15 horse-power Thomson-Houston motors. The car will be provided with vacuum and hand brakes, and the brakes will be operated by a toggle joint arrangement giving immense power. The Tripp patent roller bearings will be used throughout, and the car will be hung on trucks of an entirely new design (on which patents are pending), the equalizing bar being connected direct to journal boxes underneath, instead of passing around on top as hitherto. There are less parts and fewer bolts about the new Tripp truck than on any other form of truck, and they leave plenty of room for the application of the motors and electrical apparatus.

The McGuire Manufacturing Company, of Chicago, have within the past two years added the manufacture of street and elevated railway trucks to their specialties, and it would seem, from the increased facilities in course of construction for this branch of their trade, that it is destined to be as successful as either their switch stand or grain door lines. The company has recently purchased ground near their works, upon which stands a cottage, built by Mr. Geo. W. Cushing, O. M. P. of the U. P. Railroad, twenty years ago, for a home. It was then a fashionable residence street, but is now the center of a large manufacturing district. The new building will have a frontage of 100 feet on Morgan street by 170 feet deep, and will be three stories high. The fact that the McGuire Star grain door has been specified in every contract for cars that has been let this year, in which grain doors are to be used, would indicate that that door is really the standard door of this country and Canada, as is claimed by the McGuire people. The list of railroads now using the Star grain door includes every railroad of importance in the West, and nearly every one in the East and South.

Since Jan. 1 the door has been specified by 21 railroad companies, and has been put upon 15,448 cars.

The automatic ground switch stand, made by this company, is said to be giving general satisfaction. It is a very simple construction, made entirely of steel and malleable iron, and looks as though it might do all that is claimed for it.



BALANCED SPINDLE 48-INCH RADIAL DRILL.

The adjoining cut represents the newly improved radial drilling machine recently put upon the market by the Betts Machine Company, Wilmington, Del. Power is received by a cone of four speeds, back geared, giving eight changes to the spindle through suitable shafts and gearing.

The arm upon which the spindle carriage moves radially has a long bearing carefully fitted upon the upper part of the main column on which it revolves, when required, to any position within its range, and can be readily made fast at any point by a single clamping screw.

The spindle carriage has a horizontal movement, by hand, through a rack and pinion, and can be firmly clamped to the arm by a conveniently located lock-nut.

The vertical feed movement of the spindle has three changes and is simple and effective; it can be instantly disconnected from the spindle, which is then readily and rapidly moved through its entire traverse by a hand lever in convenient location, and retained in any position by the counterbalance, which also serves the important purpose of steadying the downward motion of the drill in passing through unsound material.

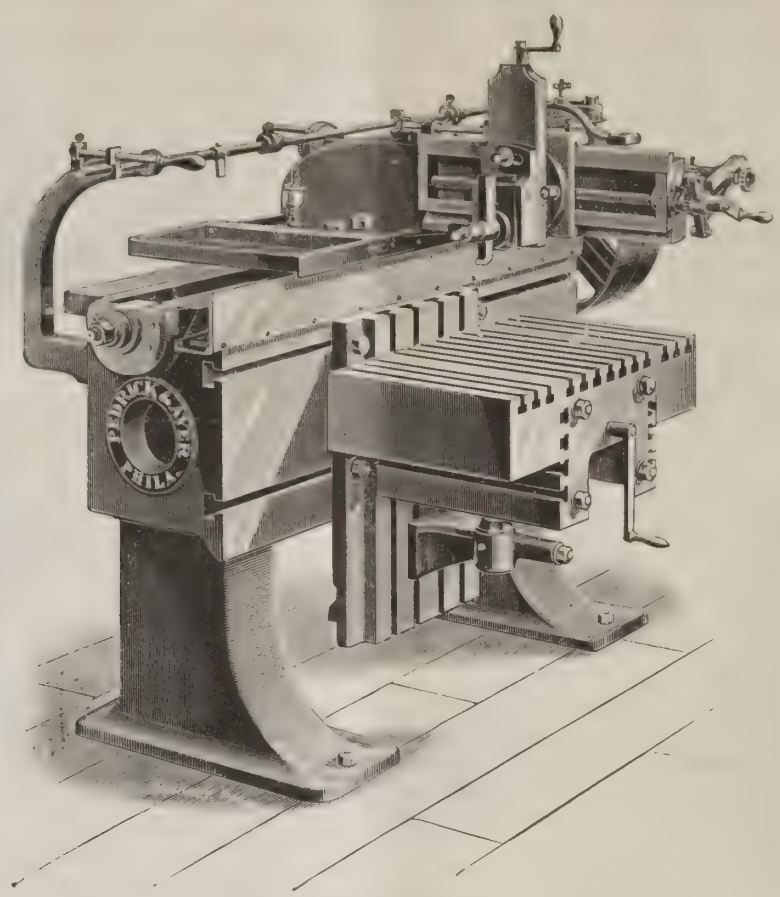
The column rests on a well proportioned base plate, truly planed and provided with T slots, on which work of a larger class can be placed and the drill spindle adjusted to operate upon any part of their surface.

Tables, for small work, can be of a variety of form, adaptable to the kind of work to be drilled; those most commonly used are the round, square hinged and box tables. The two former styles are mounted in a short column and are raised and lowered either by a screw or rack and pinion, and the latter is mounted on a slide on the side of the column and adjusted by a screw. Any further information will be cheerfully furnished by the builders.

GOVERNMENT RAILROADS OF CHILI.—These roads are managed much as many of the European railroads, except that they adopt more readily the new ideas and improvements which are introduced. The government officials have just placed an order for quite a number of our American coaches, which will have the modern improvements, among which are the Scarritt car chairs, very handsome in pattern and finish. The Wason Manufacturing Company, Springfield, Mass., are building the coaches.

The Jos. Dixon Crucible Company have issued a circular regarding their traction belt dressing and leather preservative. A manufacturer who has been using the preservative writes: "We have been using Dixon's Belt Dressing and Leather Preservative some two years, and think it the very best, and recommend it fully. We apply it with a brush or a swab on *all* our main belts, and choose for that time Saturday nights, when the work is done. We run the engine slow and apply it as evenly as we can, and by Monday morning the belts have absorbed the dressing in a great measure. By this means our belts are in good order all the time."

The Safety Car Heating and Lighting Company, New York, have issued a very attractive circular, giving an account of the progress into favor of the Pintsch system of lighting passenger cars with gas. Testimonials are given from a great many railroad officers praising the system and commending its merits. The circular intimates that the following railway companies, and both the great palace car companies, are using Pintsch gas for car illumination: New York Central & Hudson River, Cincinnati, Hamilton & Dayton, New York, Lake Erie & Western, Rio Grande Western, New York, Providence & Boston, Rome, Watertown & Ogdensburg, New York & New England, Boston & Albany, Central Railroad of New Jersey, Old Colony, Chicago & Atlantic, Louisville, New Albany & Chicago, West Shore, Wabash. Arrangements are being completed whereby during the present year Pintsch gas will be in use upon railways representing an aggregate of over 35,000 miles in this country.



THIRTY-INCH OPEN SIDE PLANER AND SHAPER.

The construction and general arrangement of parts in the machine shown in the annexed cut are somewhat different from the usual style of planers and shapers. The sliding head and cutting tool are supported by an overhanging or extended arm, moving parallel with the slotted side of bed, and the work to be planed remains stationary, being fastened to the plates or tables as may be required.

The open side permits the planing of large and difficult pieces, and, as they remain at rest while being planed, are easier to set and fasten than they would be upon a moving table or platen.

The saddle is moved by means of a screw and pulleys, with shifting belts, has quick return, and is easily controlled by the operator.

The advantages of this construction for general and heavy work can hardly be overestimated, and in no way interferes with its utility or accuracy on the lighter or finer class of work.

In machine shops having large and costly planers, much work is often done upon them at a disadvantage that might be reduced in cost by the use of one or more of these machines; in fact, there are but few shops where planing is done that would not, by the use of such machines, save money for their owners.

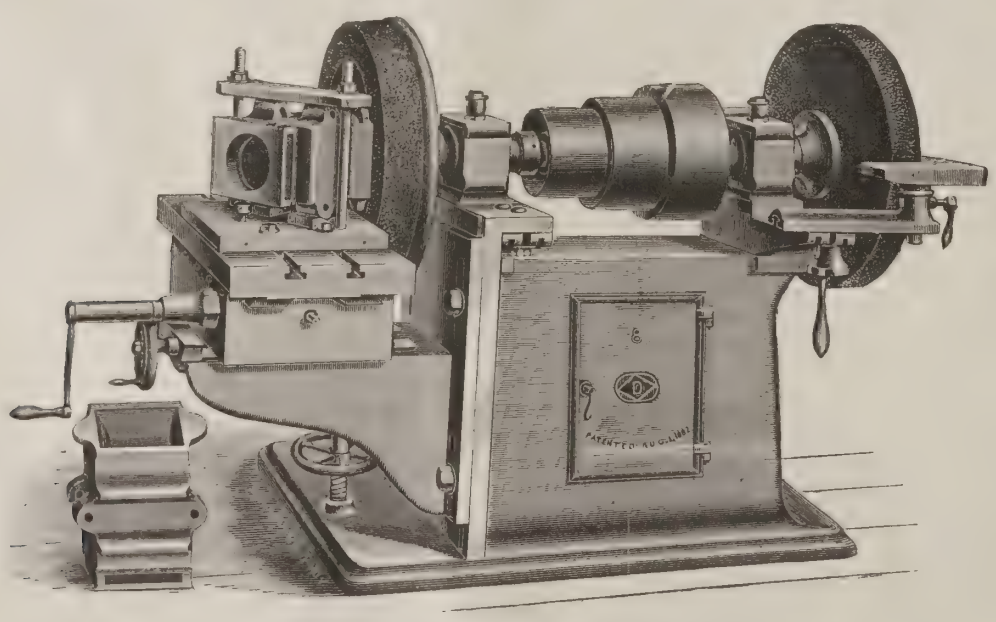
Other sizes are made, having two or more square tables and plates, to plane from 20 to 40 inches in width, and from 5 to 20 feet or more in length. The makers of these machines are Pedrick & Ayer, Philadelphia, Pa.

Mr. Corliss, builder of the famous Corliss engine, in his work on friction, gives 2,000 feet as the limit of velocity of rubbing surface per minute in machinery; and that limit was attained in tests of Magnolia Metal and under the enormous pressure of 1,425 lbs. to the square inch, which two limits are rarely, if ever, attained in practical mechanics. These tests add new proof of the value of the Magnolia Metal and of its great superiority over other bearing metals.

The Mount Vernon Car Manufacturing Company, organized at Mount Vernon, Ill., on April 11, with a capital stock of $150,000. The following directors and officers were elected: D. O. Settlemire, S. M. Grubbs, Geo. W. Evans, S. T. Strattan, Jno. C. Teuckel, W. C. Arthurs, Frank Snyder, J. R. Allen, Jas. Gowenlock, Jno. Gibson, Morris Emmerson directors; D. O. Settlemire, president; Geo. W. Evans, vice-president; W. C. Arthurs, secretary and treasurer; Frank Snyder, superintendent.

The company will occupy the large shops (covering about 25 acres of ground), at Mount Vernon, Ill., recently vacated by the L. & N. R. R. Co. moving their shops to Howell, Ind.

The company will commence, at once, erecting some additional buildings and putting in machinery, and expect in about 90 days to have in full operation a plant with a capacity of 15 cars per day. Mr. Settlemire, the president of the new company, was for 12 years president of the Litchfield Car and Machine Company, of Litchfield, Ill. Mr. Snyder, the superintendent of the company, was formally of the Missouri Car and Foundry Company, of St. Louis, Mo., and the Litchfield Car and Machine Company, of Litchfield.



DOUBLE-HEADED GRINDING MACHINE.

The machine shown in the annexed engraving is designed to run two wheels. Cup wheel is 22 inches in diameter and 5-inch face. Emery wheel can be used on the other end of spindle, 34 inches in diameter and 6-inch face. It is made to grind car boxes or other straight surfaces. The table measures 36 inches long by 13 inches wide. The length of parallel traverse is 18 inches. The end or cross traverse is 6 inches. The rise and fall to the knee is 8 inches. The movements of the table are by hand wheels, as shown.

We claim for the machine great strength in its design, unequaled workmanship, and constructed to do the work named or other straight surfaces perfectly true and in a rapid, economical manner, with every adjustment which can be required in a machine of this class.

Has steel spindle, engine lathe boxes, arm for rest—both front and back, rest being provided with wrench permanently attached to its proper place, and levers for securing the rests firmly to the frame; this latter is an invention of ours (patented Aug. 1, 1882) which every manufacturer will appreciate. The bearings are so closed as to prevent the admission of emery dust (our arrangement for this purpose, patented Aug. 1, 1882). Brass oil cups with patent oil feeders are used. A surface attachment to use on this machine can be provided when desired.

No railroad shop in the country that desires good facilities for doing work can afford to be without this machine, which is made by the Diamond Machine Company, Providence, R. I.

The Michigan Railway Supply Company, of Detroit, report business very brisk, and are working on orders for their "Central" steel brake beam for the following roads: Michigan Central, 500 60,000-pound box cars; A., T. & S. F., 100 furniture cars; Chesapeake & Ohio, 1,000 50,000 pound cars C., C., C. & St. L., 1,000 50,000-pound cars. Also filling small orders for the D., S., S. & A., K. C., F. S. & M., K. C., F., S. & G., and the Connecticut River railroads.

The magneto-electric alarm signal for highway crossings or for announcing the approach of railroad trains is highly spoken of by those using it as a measure of safety. Many railroad companies would find it a paying investment to introduce this alarm signal at crossings where watchmen are not provided. Although employing electricity, this improvement has no batteries or cups; requires no material for maintenance except oil; is not affected by frost; is easily managed by ordinary intelligence, not expert in electricity, and will repay careful investigation by railway managers. The device is manufactured solely by the Pennsylvania Steel Company, Frog, Switch and Signal Department, Steelton, Pa.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any error that may be noticed in our list:

Atlanta & Florida.—Mr. Cecil Gabbett has resigned as general manager and Mr. Thomas Garrett has been appointed superintendent.

Atchison, Topeka & Santa Fé.—Frank Bruce has been appointed division master mechanic of the Chicago line, with headquarters at Fort Madison, Ia. Richard English has been appointed master mechanic of the Rio Grande division, with headquarters at San Marcial, N. M., vice E. Hockett, resigned. James Collinson, general foreman of the Topeka shops, has been appointed master mechanic of the New Mexico division, with headquarters at Raton, N. M., vice Frank Bruce, promoted. W. E. Costello has been appointed superintendent of the Kansas City division, vice C. L. Nichols, resigned.

Canadian Pacific.—J. W. Leonard has been appointed superintendent of the Atlantic division.

Cape Fear & Yadkin Valley.—J. W. Fry has been promoted from general superintendent to general manager.

Central New England.—W. J. Cromwell has been appointed purchasing agent, with office 115 Broadway, New York.

Charleston, Cincinnati & Chicago.—G. W. Bentley has been appointed general manager.

Chautauqua Lake.—W. E. Griggs has been appointed general manager.

Chesapeake & Ohio.—H. Frasier has been appointed superintendent, vice J. C. Loomis, resigned.

Chicago & Atlantic.—G. M. Beach, general manager, has resigned. The duties of the office will be performed by V. T. Malott, receiver.

Chicago, Milwaukee & St. Paul.—C. A. Goodnow has been transferred as superintendent at Council Bluffs, and is succeeded at Dubuque by G. T. Hartigan.

Chicago, St. Louis & Pittsburgh.—W. B. Leeds has been appointed superintendent of the Southern division, vice H. L. Miller, appointed superintendent of the Jefferson, Madison & Indianapolis divisions.

Denver & Rio Grande.—Alexander Struthers has been appointed master mechanic at Grand Junction; H. H. De Renier has been appointed master mechanic at Leadville.

Detroit, Lansing & Northern.—Russell Wallace has been appointed purchasing agent at Grand Rapids.

East Tennessee, Virginia & Georgia.—E. M. Roberts has been appointed master mechanic at Atlanta.

Fort Worth & Denver.—W. F. Henderson has been appointed master mechanic, vice John F. White.

Illinois Central.—J. C. Hartington is appointed superintendent of the Chicago division, to succeed J. C. Russ. George W. Hutter has been appointed superintendent at Cairo, vice W. Wilkinson.

Iowa Central.—J. L. Gath has been appointed superintendent.

Kansas City, Wyandotte & Northwestern.—Newman Erb has been appointed receiver. E. Summerfield has been promoted from general superintendent to general manager.

Kentucky Central.—Lewis Hood has been appointed superintendent, with office at Cincinnati.

Kentucky Union.—Levi Hege has been appointed general superintendent.

Lake Shore & Michigan Southern.—J. M. Watts is appointed acting superintendent Toledo division, vice T. Fletcher, resigned.

Lanesville & Ohio River.—Nathan Wright has been appointed master mechanic.

Louisville, New Albany & Chicago.—W. F. Black has been appointed general manager, James D. Carson superintendent Louisville Southern division: E. W. Morris, superintendent of motive power; W. H. Folsom, purchasing agent.

Louisville, St. Louis & Texas.—John Storvey has been appointed master mechanic.

Louisville Southern.—W. R. Woodward has been appointed general manager, and C. J. Ranahan master mechanic.

Newport News & Mississippi Valley.—H. E. Huntington has been appointed general manager of the Eastern division, with office at Cincinnati.

Northern Pacific.—F. F. Griffith has been promoted from conductor to assistant superintendent.

Portland & Willamette Valley.—R. Koehler has been appointed superintendent.

Rome & Decatur.—J. R. Taylor has been appointed general manager.

St. Louis, Arkansas & Texas.—W. T. Smetton has been appointed superintendent, vice T. W. Kennon, resigned.

Toledo, Ann Arbor & North Michigan.—J. B. Conners has been appointed superintendent.

Employment.

SITUATION WANTED.—A young man with fifteen years' experience in car building and some years as draughtsman, desires a position as draughtsman or assistant to general foreman. Address "K.," 9 East Second Street, Wilmington, Del.

NATIONAL CAR AND LOCOMOTIVE BUILDER

JUNE. 1890.

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New York & New England have placed their order for 1,000 cars, 400 Box and 600 coal cars, with Erie Car works.

The Baltimore & Ohio are just closing large contracts for freight equipment, amounting to several thousand cars of the various patterns.

From the verbs which were suggested to him to express locomotion by electricity, Lord Bury has selected "to motor." The antithesis should be, to keely.

The machine shops of the St. Louis, Arkansas & Texas Railway Company, located at Tyler, Texas, are to be enlarged by the addition of much new machinery.

One of our subscribers, an engineer on the Southern Pacific at Dinsmuir, Cal., writes us that during the snow blockades of last winter he was thirty-one days in making a round trip.

The South Carolina Railroad Company are in the market for two hundred freight cars. This Company recently placed order with Jackson & Sharp for eleven passenger cars and will soon order several additional engines.

One of the latest sensations in transportation is the design by a civil engineer of a steamer that will cross the Atlantic in three days. The wonderful vessel will be a mixture of the American center board and the English cutter.

An engineer is usually commended for sticking by his engine and trying, to the last moment, to stop his train. It was reserved for a coroner's jury in Philadelphia to find that one poor fellow of this stamp lost his life "through his own neglect."

One of the latest pieces of startling news sent out in the press dispatches was to the effect that a train on the Union Pacific drawn by a mogul locomotive was run at such a high velocity to make a meeting point that the driving wheels melted.

The South Georgia & Florida have just placed order with the Ohio Falls Company for 7 passenger coaches, which are to be thoroughly first class. This is necessary to be in harmony with present equipment of this "Gilt Edged" system of the South.

As long ago as 1855 Mr. H. A. Luttgens, of the Rogers Locomotive Works, invented and patented an improvement on the link motion, whereby a cam was made to aid the action of the eccentrics in accelerating the motion of opening and closing the valves.

We have received the time schedule of the Stony Clove & Catskill Mountain Railroad, of which Mr. Geo. Coykendall is general superintendent. Two trains a day are run each way over the road and they carry passengers through some of the most striking scenery to be found in the country.

Ex-Mayor Grace, of New York City, is the head of a syndicate of American capitalists which has obtained financial control of all the railways in Peru. The syndicate has recently been rearranging the methods of management, and it is reported that American railroad men will be sent to Peru to take charge of all operating departments. Several skilled workmen have already been sent.

The first installment of the sixteen new coaches for the New York, Ontaria & Western, from Jackson & Sharp, has reached Weehawken, and they are certainly all that can be desired by the most fastidious of their patrons. They are equipped with steel-tired wheels of Boies, make and Frost system of lighting. This progressive management recognize the fact that it pays to make its patron comfortable.

A somewhat startling novelty in railway construction comes from Mexico in connection with the building of the new Monterey & Mexican Gulf Railroad. If the equipment be equal to the track, the line must certainly be classed A 1 among railways, for it is reported that its sleepers and woodwork are mostly made from mahogany and rosewood, while the bridges and culverts are built of marble, both the wood and stone work being abundant along the route.

Mr. J. Snowden Bell, of Pittsburgh, has invented and patented an improvement in locomotive spark arresters designed to obviate the use of an extension front. He applies a double diaphragm in front of the tubes one set above the other, angling apart. The lower part is perforated with holes and the upper one is solid. The netting extends downwards from the front of the steam pipes, and forms a W in the smoke box, materially increasing the surface through which the products of combustion pass.

The latest absurdity in the line of transportation is that two German engineers propose to use three continuous platforms moving along the streets side by side. The lowest of these platforms is 4 inches high, and moves at a uniform speed of 5 feet per second. Any ordinary pedestrian can, they state, mount this platform from the ground without difficulty, and from this he can with equal ease step on to a second platform 4 inches higher than the first, and moving twice as rapidly. The passenger thus acquires a speed of 10 feet per second, and, stepping on to the third platform in the same way, he is carried at a speed of 15 feet per second, or 10 miles an hour, to his destination, where he steps off in the inverse order.

The Elliott Car Works at Gadsden are in full operation, giving employment to 250 men, the greater portion of them being skilled mechanics. The plant was located out on a large level plat of ground two miles from the court house, on line of the Gadsden & Attalla dummy railroad. The buildings consist of four large car shops 50×200 each, with iron roofs. The round house is 80×270 feet. The pattern shop is 40×80 feet. The core ovens are 16×40 feet. The foundry contains two cupolas, one for car wheels and one for common castings. They consume 30 tons of iron daily. All kinds of freight cars are built here, including flat, gondola, box or caboose cars, both of iron or wood. An average of about 150 cars per month are turned out of these shops.

A. Rondouter, who likes a good cigar, was on his way to Buffalo. Before the train reached Syracuse there was general complaint that there was no smoking-car, and the conductor was appealed to to add one to the train. "Well," he said, "after we leave Syracuse you may smoke in this car." There was but one woman in the car, and she was sitting by an open window. She was an Emerald Islander. Her ticket was to Syracuse, and it was on her account that the conductor would not let the other passengers smoke. She sat near the front of the car, and the conductor, suddenly entering after leaving a station just this side of Syracuse, saw the woman covering with her hand something she had in her mouth. "What are you doing?" he asked her. She looked up, with a sly twinkle in her eye, and answered: "Shtealin' a smoke!" She had been smoking a pipe all the way from Albany.

A press dispatch recently said: The boiler of an engine on the Reading Railroad exploded this morning at about three o'clock at Paxinos, with fatal effect. Engineer Hiram Hanglegans, of Tamaqua, a married man, and Fireman Charles Kauffman Gordon, single, were killed. Conductor George Yeager, of Tamaqua, received severe internal injuries and concussion of the brain. The engine that exploded was what is known as a dirt-burner, a freight engine of large pattern. Conductor Yeager had been sitting in the engine and was blown straight up in the air and fell on his head. It was miraculous how he escaped with his life. The bodies of the other two men were found some distance back of the engine in a ditch between the trains and a deep rocky hillside. Both were dead when found. The engine was a complete wreck. A tool-house standing alongside the track was set on fire, burning down, and a car loaded with dynamite was crushed, fortunately without exploding. Brakeman Keefer had a narrow escape. He had just stepped off the engine back on the train when the explosion came.

Norman Beckley, general manager of the Cincinnati, Wabash & Michigan, has voluntarily increased the wages of engineers, trainmen and yardman. In making the announcement of the increase the manager thanked the employes for their faithful service and gave them some good advice as to their future conduct. The circular concludes: With the advance of wages you may be able with prudence and economy to provide a home and lay by for a rainy day. Railroad men should occupy a position in society and become citizens of influence, and in no way can they do this so well as by establishing themselves in their own homes. The management wish to encourage men in making homes and in order to do this will transport for them all building material at low rates. They wish, also, to assure men that they will be retained in the company's service, provided they are loyal and industrious, and that vacancies shall be filled by promotion as far as possible. Men who save money and build homes make the best employes and will be given preference. Men who are never absent from duty, who lose no time, are preferable. Men who are prudent in their habits, do not drink, nor use profanity, will be appreciated, and will be encouraged and promoted, knowing that the company's interests are safe with such men.

Through some blunder on the part of the post-office or the parties writing the address, a package of drawings of the Baldwin compound locomotives sent to us by the builders went astray, and we were unable to show up the engine at the time the other railroad papers were doing so. The engine is of the eight-wheel type, and four cylinders are used, two on each side, one above the other, and both connecting to one cross-head. There is no steam receiver between the cylinders, the high-pressure exhaust steam passing direct into the low-pressure cylinder. The steam for both cylinders is distributed by ingeniously designed piston valves that are operated from the shifting link direct without the intervention of rocker. A simple form of slide valve is used as a starting valve to admit steam direct to both cylinders. There are very few extra parts to the locomotive boyond those used with a simple engine.

A number of prominent railroad men have been examined lately by the United States Senate Committee on Commerce to find out their views on an enactment making it compulsory for railroad companies to equip their cars within a certain limited time with automatic brakes and couplers. Among those examined were President Roberts and Mr. Theo. N. Ely, superintendent of motive power of the Pennsylvania, and Mr. Brown, general superintendent of the Michigan Central. The most important evidence was given by Mr. Ely, who favored safety appliances, but thought they were being applied with reasonable rapidity. The best type of automatic coupler, Mr. Ely continued, was better than the link and pin coupler, but most of them were more dangerous. The Pennsylvania Railroad had 10,000 freight cars, about 10 per cent. of its entire number, equipped with power brakes and auto-couplers; and in about this proportion the entire freight equipment of the country was provided with these appliances. Mr. Ely said that the establishment of a board of inspectors, attached to the Interstate Commerce Commission, whose recommendations shall be followed, was the best solution of this question. He felt satisfied that such a board would recommend that the railroads be left alone to work out the problem, as they are now doing.

Vice-President Sterling, of the Illinois Steel Company, at Joliet, submitted to the employés a proposition for profit sharing at a special meeting called at the Auditorium. The assembly room was well filled, and all the officers and superintendents occupied seats on the platform. Mr. Sterling said that, after considering the many plans of profit-sharing, they had concluded to improve on all other systems, which so far were not unqualified successes, by paying a quarterly premium for faithful, competent, zealous and continuous service. Employés would, on application, receive 1 per cent. for the first year, 1½ per cent. for the first year and a half, and so on up, ½ per cent. increase for every six months, till it reached five years, and 5 per cent., when it would remain permanent. This percentage is on the amount of wages recieved, the object being to get better work, more of it, and less waste by trained employés in continuous service. Mr. Sterling said the benefits of such a system were mutual. The war cry in Scotland was "stand shoulder to shoulder," and if capital and labor stood shoulder to shoulder the world would soon see wonderful things. Superintendent Pettigrew made some encouraging remarks, and the men showed their approval by loud and frequent applause.

Exhibits for the Conventions.

Mr. John W. Cloud, Secretary Master Car Builders' Association, wishes us to announce the following:

If manufacturers and others who contemplate having articles on exhibition before the Master Car Builders' Association at Old Point Comfort, Va., will have them addressed to themselves in care of Mr. F. N. Pike, Manager, Hygeia Hotel, he will attend to receiving them and having them brought up from the steamers and trains, for which service a reasonable charge will be made.

Transportation to the Conventions.

Several parties have been arranged to go to the conventions at Old Point Comfort by water, leaving New York by the Old Dominion steamship line on Saturday morning. Those who are not provided with transportation will be interested in knowing that the Philadelphia & Norfolk Railroad Company have arranged for through return tickets from New York for $13, which gives the holder the privilege of traveling one way by water, and that low rates will be given from all points. Parties interested can obtain full information at any of the Pennsylvania Railroad offices.

Members of the associations who require transportation over the Chesapeake & Ohio can obtain it by applying to Mr. W. Garstang, Superintendent of Motive Power, Chesapeake & Ohio Railroad, Richmond, Va.

Locomotives Best Adapted for Heavy Train Service.

We published last month a number of letters from the heads of the mechanical departments of leading railroads on the kinds of locomotives they considered best adapted for heavy train service, and we now have pleasure in publishing more letters on the same subject.

Mr. Herbert Wallis, Grand Trunk Railway, writes:

We use mogul or six-coupled driving wheel engines for passenger trains only when a heavy train is to be hauled, with frequent stops, in which case the speed is reduced.

Ten-wheeled engines, by which I understand six-coupled driving wheels and a four-wheeled truck, I have not used for any service, believing that better results at less cost are obtained from the mogul type with its single or two-wheeled truck.

Our standard types are:

For passenger service, four-coupled drivers and four-wheeled trucks. 18 inches by 24 inches by 6 feet 1⅝ inches, and 5 feet 8 inches, the wheel dimensions being outside the tires.

For freight service, 18 inches by 26 inches by 5 feet 2 inches, mogul type.

For branch train, passenger or mixed service with tank or tender, 17 inches by 22 inches by 5 feet 4 inches, "4-coupled."

For shunting, 18 inches by 22 inches by 4 feet 9 inches, six-coupled, without truck.

It seems to me that when passenger trains become so heavy as to require the use of mogul engines, the trains would be increased in number, and the service divided as between "through" and "local" to the improvement of each class.

I can understand cases in which mogul engines could be worked with advantage on passenger trains, but think they are exceptional.

Mr. Henry J. Small, Southern Pacific, writes:

I regret that I am unable to give you comparative figures on this question, as we have not yet used ten-wheel engines for passenger trains on level divisions. We do use them on our mountain grades, however, and certainly should use them on level divisions when trains exceed such proportions and speed as to exceed the capacity of eight-wheel engines of certain dimensions. The condition of track and weight of rail will, perhaps, govern the maximum weight of eight-wheel engines, which, on the average Western road, cannot safely exceed 65,000 pounds on drivers. On the best ballasted road, with heaviest rail, 75,000 pounds on drivers is as great a weight as can be successfully handled. When the weight of trains and the requirements of speed necessitate greater adhesion and traction capacity, it seems to me the only natural thing to do is to add another pair of drivers with requisite increase of cylinder area and boiler capacity; in my opinion such an engine can be operated more economically than an eight-wheel engine of greater weight than figures above stated.

This economy will apply not only to the operation of the engine itself, but also to the track, and in every respect I think the ten-wheel engine preferable to an excessively heavy eight-wheel engine.

Mr. F. Hufsmith, International & Great Northern, writes:

I fully concur with you as to the ten-wheel engines being the most economical in either freight or passenger service, and regret that I have no data on hand to furnish you to compare the ten-wheel locomotives with the eight-wheel locomotives in passenger service; but we have quite a number of ten-wheel locomotives in freight service, and my experience is, the cost to operate the ten-wheel engines is not any more than the eight-wheel engines, yet our ten-wheel engines haul 8 per cent. more cars than the eight-wheel engines, and do less damage to track. Cost of fuel and repairs equal.

Mr. S. B. Haupt, Norfolk & Western, writes:

I have given this matter considerable attention, but purely from a local stand-point. I can hardly say that I am prepared, therefore, to express an opinion generally upon the subject.

Our own experience in the use of ten-wheel engines, so far as we have gone, has been eminently satisfactory. There are certain portions of our line over which we have found it impossible to haul our heavy passenger trains, consisting of 8 to 10 cars, with our present type of eight-wheel passenger engines. To increase their power, meant of course, increased weight upon the drivers, and we did not feel that we had reached the point where we could increase the weight of our eight-wheel engines with safety. We therefore designed the ten-wheel passenger engine, with a good large boiler and fire box, so that steam could be supplied in sufficient quantities, without crowding the fire, wasting fuel, etc., and with these engines in the same service formerly performed by the eight-wheel passenger engines, we find the work is handled with a saving of fuel. The engines handled the work with ease, and make schedule time over grades which have heretofore been very troublesome with the eight-wheel engines.

I give you the above information purely as our own experience; yet, with all points considered, we have been able to accomplish with the ten-wheel type of passenger engine what we failed to do with the eight-wheel engine. The conditions to be met with on the different roads are so variable that I should consider it difficult to determine upon any single type of locomotive that would answer equally well all over the country. I have no doubt that on level roads the present type of heavy eight-wheel passenger engines will haul as much of a train as any of the lines have occasion to carry; so that, with such roads, the ten-wheel type may be considered an extra expense, not warranted. With us the ten-wheel passenger engine was necessary, because of the numerous grades, ranging from one to five miles in length, over the greatest portion of our line.

Mr. R. W. Bushnell, Burlington, Cedar Rapids & Northern, writes:

I have to say that I have had no experience with ten-wheel engines in passenger service. We have, however, 25 ten-wheel engines in freight service, the performances of which, as compared with eight-wheel engines, I give you, as taken from our performance sheet for the month of February:

Average number of cars hauled by eight-wheel engines	13.15
Average number of cars hauled by ten-wheel engines	17.45
Average cost per engine mile of eight-wheel engines	17.31 cents.
Average cost per engine mile of ten-wheel engines	18.62 cents.
Average cost per car mile of eight-wheel engines	.013163 cents.
Average cost per car mile of ten-wheel engines	.01067 cents.
Average cost per car mile for engineer, engine and trainmen of eight-wheel engine	.014338 cents.
Average cost per car mile for engineer, engine and trainmen of ten-wheel engines	.018031 cents.

The car mileage for the route was about 3,000,000 miles. Had this work been done by the eight-wheel engines the cost for engine and trainmen service would have been $54,094.20, if with ten-wheel engines the cost for service would have been $43,014, making a difference in favor of ten-wheel engines of $11,080.

With eight-wheel engines 2,281.3 trips of 100 miles each would have to be made to do the work of the month, while with ten-wheel engines only 1,718.6 trips would be required, showing a difference in favor of the ten-wheel engine of 562.7 trips.

Allowing the mileage of each engine to be 3,000 miles for the month, it would require 76 eight-wheel engines to do the work of the month; with ten-wheel engines only 57 would be required.

In addition to the above there would be a saving of room required for round house and shop purposes, also in the number of round-house men required to take care of engines.

Where the business and conditions of a railway are such that ten-wheel engines can be used, there can be no question as regards the economy in using them.

Under the same conditions I see no reason why a ten-wheel engine might not be used in passenger service with equally good results.

Mr. John Hickey, Milwaukee, Lake Shore & Western writes:

I cannot at this time give you comparative figures as to the economy of operating eight and ten-wheel locomotives. I am engaged in making some tests between moguls and eight-wheelers, but have not yet reached definite conclusions. To my mind there is no question of doubt about the correctness of the position you have taken as to the economy of operating eight and ten-wheel engines. It is certainly clear that the larger amount of weight of any locomotive that can be used for adhesion, the greater economy there is in operating it. The mogul type of engine is without doubt the most economical kind of engine that can be used for freight service.

Mr. Harvey Middleton, Atchison, Topeka & Santa Fé, writes:

Upon receipt of your letter regarding the use of ten-wheeled engines for passenger service as compared with eight-wheeled engines, only having had casual experience with ten-wheelers on passenger trains, as we only use them on the mountain divisions of our line, where, of course we find it more necessary than on the level divisions, I referred your communication to Mr. L. H. Waugh, master mechanic of our Western division at La Junta, who is one of the oldest men in the service of the company, and, rather than pick out extracts in regard to the matter, I enclose herewith a copy of his reply to my letter. You will pardon the names of engineers and others connected with it, but I think that you can get the points that you desire from it.

My opinion, as well as my experience, convinces me that ten-wheeled engines on level track do not give as good service as eight-wheeled engines properly proportioned, either 18 or 19-inch diameter cylinders, and from the fact that on our level divisions we pull long trains of 10 and 12 cars, making fast time with them, it goes to show that they can be worked quite as well, and, in my judgment, more economically than the ten-wheeled engines.

The comparisons that Mr. Waugh has made I think will give you the information asked for in the last part of your letter.

Of course, as to the freight service, I am of the opinion that good ten-wheeled or consolidated engines are by far the best for most divisions, particularly those on the mountains.

The letter from Mr. Waugh, which Mr. Middleton requested should not be published, took a decided stand against ten-wheel engines for passenger service. He regarded them as being particularly severe on the track, and as being decidedly more expensive for fuel, lubricants and repairs than eight-wheel engines doing the same work.

Mr. H. Roberts, Chicago & Grand Trunk, writes:

I have never had any experience with ten-wheeled locomotives in passenger service. We use heavy eight-wheeled engines altogether for that purpose. Our road is very level, and I consider an eight-wheeled engine is the best adapted for that class of work on level roads. We also use eight-wheeled engines for freight service. We have a few mogul freight engines, and the increased load is so small as compared with the extra cost of the repairs, that I would not advocate their adoption on level roads, particularly in the fast class of freight service which we have.

Mr. L. B. Paxson, Philadelphia & Reading, writes:

I have had no experience in the use of that class of engines on passenger trains, consequently cannot give an opinion, from practice, as to their merits. I am, however, inclined to think, from some engines that are being built for different railroads, and some little experience that I have had in the last two weeks with some ten-wheeled freight engine with five-foot wheels, that they certainly would be a very efficient engine for the handling of passenger trains on roads with heavy gradients.

Mr. W. S. Morris, Chicago & West Michigan, writes:

While with the Wabash I had quite a number of ten-wheeled engines in freight service that gave excellent results both in fuel, consumption and increased percentage of cars handled, over the eight-wheeled class of engine. I have not the data to give you the figures you ask, as I am not using ten-wheeled engines on these lines, but from the experience I have had, where it is necessary to use heavy engines, in either passenger or freight service, I prefer the ten-wheeled engine.

Mr. W. T. Reed, Chicago, St. Paul & Kansas City, writes:

Practically, a ten-wheeled engine will certainly haul more cars than that of the eight-wheel, owing to an increased adhesive power, taking the same sized cylinders. For heavy passenger trains, I consider the ten-wheeled engine is necessary; it is in the starting of a train where the eight-wheelers lose time, and where the ten-wheeler gets out of town, which is a consideration in this country where there are so many railroad crossings and short stops. If our train service was similar to that of the Old Country, where they make the whole journey and only stop once or twice, the eight-wheeler would be more desirable.

Further, it has not been considered prudent to run passenger trains in sections where there are only a limited number of cars. Eight-wheeled engines on ten-car passenger trains, having heavy sleepers and dining cars, are not adequate for requirements. The time has not yet arrived where all companies can afford to run a train consisting of only first-class passengers, hence heavy passenger trains are hauled and have to make schedule time.

Mr. J. N. Barr, Chicago, Milwaukee & St. Paul, writes:

In the matter of ten-wheel engines for the use of passenger trains, my experience is somewhat limited in this respect; but we have used two ten-wheelers in passenger service to some extent, and we have had more or less trouble from hot boxes and hot pins. I am inclined to think that the arrangement of the machinery necessitated by the use of six wheels connected is more liable to give trouble from heating than with the standard eight-wheel engine, and, while this may be a matter of detail which can possibly be overcome, our experience would indicate that it is quite serious in using ten-wheel engines on fast passenger trains.

Mr. W. T. Small, Northern Pacific, writes:

"While I have no special data to give you in regard to the relative merits of an eight-wheel and ten-wheel engine, I am satisfied that the ten-wheel engines are giving us better satisfaction for the same expense than the eight-wheel engines. This, of course, is for heavy trains, but it is not clear in my mind that a ten-wheel engine will give any better results in passenger or freight service than a mogul, and I hope soon to be able to make a test of the different classes of engines, *i. e.* standard, moguls, and ten-wheelers, as to economy for use in passenger service; but at the present time I can only draw my conclusions from what I can see of their performance. I find that during the winter season a ten-wheel engine does remarkably good service as compared with an eight-wheel engine. Increased percentage on passenger trains amounts to about 25 per cent. and on freight trains to 50 per cent. in favor of the ten-wheel engine. Regarding comparison between above type of engine in connection with fuel per mile run, consider there would be little or no increase. There would be a slight increase in cost of repairs to the ten-wheeler over that of the eight-wheeler, which would figure very light on a well-proportioned engine, making 80,000 to 100,000 miles between back-shop repairs.

Mr. B. R. Harding, Raleigh & Gaston, says:

We have had no experience with ten-wheel engines on our line. We have 46 eight-wheel engines, varying in size of cylinders from 15 x 24 to 18 x 24, on a crooked road, with a maximum grade of 72 feet per mile. Our 15-inch cylinders are allowed a train of 18 cars on 50,000 pounds each, and the 18-inch 27 cars, which they pull with ease, making 40 miles per cord of wood, with a cost for repairs of 3½ cents per mile.

We are not averse, however, to the use of ten-wheelers, as we have recently placed an order for six, which we expect to use on the heavier divisions of our line; and as soon as I can get the benefit of their experience, I will be most happy to enlighten you as to their performance.

I should think, from the introduction of so many ten-wheelers into service on the roads North and West, that there must be some economical points in their favor, or the roads would never adopt an engine which would increase expenditure.

Mr. W. F. Turreff, Cleveland, Cincinnati, Chicago and St. Louis, mentioned that his company have just lately ordered some ten-wheel engines for passenger service, but they have not yet had experience with engines of that type for the service in question.

Mr. Henry Schlacks, Illinois Central, said that they have only recently put ten-wheel engines into passenger services, and they expect to make some tests of the performance soon.

Mr. J. W. Agnew, South Carolina, uses ten-wheel engines in freight, but has not figures to show their performance compared to that of smaller engines.

Mr. John Henney, Jr., New York, New Haven & Hartford, has eight-wheel, ten-wheel and mogul engines in freight service, and the moguls haul more cars than the others. For heavy trains and steep grades would prefer ten-wheel engines for pasenger service with valve motion suitable for fast running.

Mr. G. W. Tilton, Chicago and Northwestern, writes that he had no experience with ten-wheel engines on passenger service. They have been giving the matter consideration, and he is inclined to believe that, under certain conditions, such engines are economical.

A number of other correspondents mentioned that they were watching the use of ten-wheel engines in passenger service with interest, but that they had had no personal experience with them.

Efficiency of Locomotives.

At the Cincinnati meeting of the American Society of Mechanical Engineers Mr. W. F. Dixon read a paper on the above subject. An examination was made in the paper of the objections to the shifting link motion and its distribution of steam, and reasons were advanced for the belief that the objections were without real foundation. The author said: The clearance spaces in any cylinder bears such a close relationship to the compression curve that they must enter into all discussions of it. In engines like the locomotive, where a single valve controls all the events of the stroke, it is undesirable to reduce the clearance spaces to less than seven or eight per cent. of the piston displacement, for at short points of cut-off the compression line would run up so abruptly as to reach initial pressure before the piston had reached the end of the stroke. From one point of view, the steam of compression should reach a pressure just sufficient to arrest the motion of the piston, crosshead, etc. Any increase above this detracts unnecessarily from the area of the indicator card, but does not diminish the efficiency of the engine. On the other hand, if compression is carried to initial pressure, none of the incoming steam is required to fill the clearance spaces and to raise the cylinder walls to a temperature as high as its own. This is indubitably the reason why the locomotive engine at high speeds and short cut-offs is as economical a machine as it is. The reduction of indicator card area caused by early exhaust closure, and the large clearance spaces found in locomotive cylinders, is often overestimated. A certain engine, with a 24-inch stroke and worked with 160 lbs. boiler pressure, has clearance spaces equal to 10 per cent. of the piston displacement. When cutting off at six inches it has been found necessary, to insure smooth running, to compress to 54 lbs. To do this the exhaust must be closed at 15.28 inches on the return stroke. Suppose, now, it was possible to reduce the clearances to two per cent., steam being cut off at six inches as before. To compress to 54 lbs. the exhaust must close only after 22.25 inches of the return stroke have been traveled.

When the clearances were 10 per cent., the M. E. P. was 94.6 pounds, sinking to 91.8 pounds when the clearance was reduced to two per cent.

If compression takes place suddenly, as is the case in cylinders having very small clearances, the heat does not have time to become equalized between the steam and the cylinder walls, and the power required for compression will be in excess of that necessary were the action to take place more gradually.

The various means resorted to in order to prevent cylinder condensation were discussed, and the author expressed the belief that steam jacketing could be used to advantage.

The history of compound locomotives was outlined, and mention was made of the Remington compound motor used for years successfully on the Worcester & Shrewsbury Railroad, a description of which was given in a recent issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER.

The author believed that increased economy of steam would result from the use of high pressure, but he considered 200 pounds per square inch about the practical limit. Above that pressure the temperature would destroy lubricants and packing so readily that the cost of maintenance would exceed the saving of fuel.

Mr. Angus Sinclair agreed with the author of the paper that the objections to the link motion were often exaggerated. Those who tried to improve the locomotive by abolishing the ordinary valve motion had met with uniform failure. He did not think that steam jacketing had ever proved a decided success on high speed engines, and all attempts that he was familiar with of improving the locomotive by means of steam jackets had proved failures. He believed that cylinder condensation used up a great deal of steam, although it could not be detected in indicator diagrams. There is so much of what Hemenway calls "initial expansion" in the cylinders of high-speed locomotives, that it is impossible to judge how much of the drop is due to condensation or to wire drawing. Nozzles and contracted steam passages exert so much influence on the exhaust end of the card that it is practically impossible to detect the signs of re-evaporation.

Mr. L. S. Randolph said that, in regard to the efficiency of the locomotive, the question has been and is now not so much what is the efficiency of the locomotive, but what is its power; not so much how many foot pounds of energy it will develop per 100 pounds of combustible, but how many cars it will haul and make schedule time. The tests of the efficiency of a locomotive, as usually made, are not only exceedingly difficult, but not very reliable. The varying factors of grades, curves and speed, together with the comparatively short time it is possible to give to the tests (not more than five or eight hours at the most), make it impossible to get the accuracy and reliability that the subject demands. Not until we take a leaf from marine engineering and make as it were "dock trials" of a locomotive, will we get the accuracy and reliability that we should. With the locomotive blocked up, a pillow block substituted for the driving box, and a prony brake to measure the power developed, we should be able to get, with accuracy, the efficiency of the locomotive under varying conditions of load, speed, etc., other conditions being kept uniform. Knowing these points accurately, we could determine how much was gained or lost by overloading or underloading an engine, as well as the effect of varying dimensions.

Mr. W. E. Hall held that in handling the compression question care should be taken not to allow it to be too high, especially with engines running at high speeds, where, with the motion cut back, it is apt to choke the engine and increase the back pressure,and thereby interfere with the working. He believed that any economy obtained from the use of compound locomotives was due entirely to the increased use of the steam expansively, and that cylinder condensation had nothing to do with it. The compound principle took away from the engineer the control of expensive working, and there was where the gain lay.

Mr. Wm. O. Webber held that the locomotive represented the highest type of high speed engine working under unfavorable conditions.

Mr. G. A. Strong maintained that the locomotive was not wasteful if not pushed beyond its capacity. Under existing practice from 1,000 to 1,500 horse power was frequently required from a locomotive of 600 H. P. capacity.

Mr. D. A. Barnes favored throttling as a means of preventing priming when engines had a tendency that way. He questioned the accuracy of the published records about the water used by locomotives and did not believe that mogul engines were harder on bridges than eight wheelers.

Brake Beams.

The report submitted to the Master Car Builders' Association a year ago on standard brake gear, raised some questions about the stiffness of metal brake beams that were of great interest to railroad men. The National Hollow Brake Beam Company, of Chicago, desiring to obtain expert information on the subject, employed Professor Johnson, of Washington University, to make a study of the tests published in the Master Car Builders' report, and the following report was made:

There are three important qualities required in a good brake beam. They are strength, stiffness, and elastic resilience or springiness, or that quality by which they may be able to resist shocks or blows, or sudden jars. This latter quality of resilience is apt to be opposed to that of stiffness, but it is very desirable to have both qualities represented in the same beam to a high degree.

I find this to be true in your beams. In fact they excel all others tested in all three requirements.

I have tabulated the results of my analysis on the accompanying sheet. Since the beams were of varying weight, the results could only be compared by dividing all the results by their corresponding weights, and so obtaining the results per pound of metal in the beam. This is a fair basis of comparison, since all these results vary directly with the weight.

To be sure, when reduced to a weight of metal of one pound, the results do not represent any physical fact, as shown in the test—for we could not have a beam weighing one pound—but they are the true expressions of the relative strength, stiffness and resilience of the beams. Thus if a beam weighing 100 pounds has an ultimate strength of 53,400 pounds, we may say its strength is 534 pounds for every pound of iron in it; and if another beam weighing 80 pounds has a strength of 37,300 pounds, we may say its strength is 466 pounds for every pound of iron in it. We thus obtain figures which are directly comparable, and in no other way can these results be directly compared.

Similarly with the stiffness. The greater the deflection the less the stiffness, or we may say that the stiffness varies inversely with the deflection. That is to say, when the deflection is twice as great the stiffness is one half as great.

Also, the stiffness is greater as the weight is greater, or it increases directly with the weight.

To obtain an accurate basis of comparing the stiffness of the beams tested, I have computed the load required to deflect each beam 0.01 in. per pound of weight of beam. That is find the load required to deflect the real beam 0.01 in. and divide this by the weight of the beam, the same as was done for strength.

The elastic resilience of the beam is the measure of the shock or blow it can absorb without being permanently distorted. It is found in inch-pounds per pound of weight of beam by taking those tests which just come up to the elastic limit, multiplying one-half the load at this point by the deflection, and dividing this by the weight of the beam. It may not be clear how this is a true measure of the elastic resilience or "shock power" of the beam, to still remain uninjured, but all scientific experts would understand it. It is in fact the measure of the work or energy spent in the beam, per pound of metal in it, to deflect it up to its elastic limit. Although this property may seem somewhat abstruse in this form, still it is exceedingly important to all forms of mechanism about freight or passenger cars, where such shocks or blows are very common.

The stiffness is necessary to prevent the necessity of an excessive movement of the air piston, or main brake rod, but it should be attained without any sacrifice in resilience. As may be seen by the appended tabulation the National beam does combine both of these qualities in an eminent and superior degree.

Thus the National beam is 15 per cent. stronger, 21 per cent. stiffer and 30 per cent. more resilient than the Pennsylvania Railroad beam per pound of metal; 19 per cent. stronger, 7 per cent. stiffer and 37 per cent. more resilient than the Westinghouse beam per pound of metal; and 28 per cent. stronger, 116 per cent. stiffer and 56 per cent. more resilient than the Central beam per pound of metal.

The above percentages are taken directly from the average results in the accompanying table.

The P. C. & St. L. beam did not have any elastic limit determined, but the National beam was 26 per cent. stronger and 26 per cent. stiffer per pound of metal than the one specimen of this form which was tested.

All these percentages are obtained on the same basis, namely, of an equal weight of metal in the beam. The original tests themselves furnish a basis of comparing the beams as actually constructed and tested.

I attribute the increased values found for the National beam to the observance of true scientific principles in its construction, especially in the character of the end joint, and in the use of a hollow compression member. I do not see how it is possible to get better results out of a given weight of metal.

A supplementary report says:

In reply to your favor of the 18th inst., inquiring as to the way in which resilient action of brake beams affects their life and utility, I would say:

1st. Some resilience or spring in the beam is necessary to protect it from harm when sudden shocks or blows come upon it. It must have strength to withstand the dead pull of the brake rods, but strength alone will not resist shock. We must combine strength with deflection, or distortion under load, to get resilience, or resistance to shocks. In order that the beam may remain uninjured, also, this distortion or deflection must be within its elastic limit. That is to say, it must not take a permanent set. It is well known that wood will take a permanent set, under a very small load, if it is long continued, or if frequently imposed. Although such a beam has great resilient action under a single or under a few shocks, this resilience is not elastic resilience; that is, it is not within the elastic limits of the material. It is only the elastic resilience, therefore, which is valuable in a brake beam.

2d. It may be shown that a trussed beam gives not only a greater strength, but also a greater stiffness and a greater elastic resilience than any other form of solid beam, or plate girder. This is but a matter of mathematical analysis, provided all are of the same material and of the same weight.

3d. Of different kinds of trussed beams, all of the same span and depth of truss, or length of middle strut piece, that form will have the greatest strength and elastic resilience, for a given weight, which allows of the highest stress in the parts, before taking a permanent set. In any properly proportioned beam of this character, the back strut will give way first by buckling up under a compressive stress, and thus take a permanent set and require a re-adjustment of the brake rods.

It is an experimental fact, also sustained by theory, that a hollow cylindrical form gives greater strength in compression than any other, and allows of a higher stress before coming to its elastic limit. This explains why the hollow compression member of the National beam gives both a higher strength and also a higher elastic resilience than the solid forms.

That this conclusion is borne out by experiment is abundantly shown by the Altoona tests, where the elastic resilience of the National beam, in inch-pounds per pound of metal in the beam is 50, while that of the Pennsylvania Railroad beam was but 21; for the Westinghouse, 19. This measure of resilience is found by multiplying the load at the elastic limit by one-half the deflection at that point, and dividing by the weight of the beam.

COMPARISON OF BRAKE BEAM TESTS BY M. C. B. COMMITTEE.

For Strength, Stiffness and Elastic Resilience per Pound of Metal in Beam.

NAME OF BEAM.	Weight.	Load of 15,000 lbs.		Ultimate strength.	Strength per pound of iron.	Stiffness = load to deflect beam 0.01 in. per pound of iron.	Elastic resilience in inch-pounds per pound of iron.
		Deflection.	Set.				
	Pounds.	Inches.	Inches.				
National, No. 1	46.5	0.12	0.00	25,350	545	26.8	30.0
" No. 2	51.1	.115	.01	28,000	549	25.5	
" No. 3	64.1	.08	.00	35,500	555	29.2	
" No. 4	100.0	.055	.00	53,400	534	27.3	
" No. 5	99.5	.06	.00	47,500	480	25.2	
				Mean	= 533	26.8	
P. R. R. (Westinghouse type), No. 1	80.0	.06	.01	37,300	466	20.8	21.1
" " " No. 2	72.5	.105	.01	34,000	469	19.6	
" " " No. 3	69.5	.105	.005	30,000	432	20.4	
" " " No. 4	68.0	.09	.00	36,200	532	24.4	
" " " No. 5	66.0	.09	.01	27,500	417	25.2	
				Mean	= 463	22.1	
P. C. & St. L., No. 1 (Westinghouse type)	64.	.11	.00	27,000	422	21.3	
Westinghouse, No. 1	76.	.105	.015	32,000	421	18.7	18.9
" No. 2	88.	.06	.00	34,000	386	28 2	
" No. 3	78.	.09	.00	38,860	498	21.3	
" No. 4	79.5	.06	.00	38,700	490	31.5	
				Mean	= 449	25.	

Driver Brakes.

At the May meeting of the Northwestern Railroad Club Mr. William McIntosh read a paper on "Driver Brakes." He said that driver brakes had made their way against the opposition of the mechanical departments and of locomotive engineers. The objections made to these brakes was that they must prove injurious to the motive power; but experience had shown that a good driver brake with a Ross shoe acting on the flange and outer rim of the tire was a positive advantage. He believed that all wheels of a train should be braked except the forward truck of the engine. He discussed at some length the different methods of hanging driver brakes, and favored the arrangement which placed the shoes in line with the axles.

The paper was discussed by a number of gentlemen interested in the brake question, and considerable difference of opinion was manifested. A paper was read from Mr. Jas. Howard, of the Beals Brake Company, who took a decided stand in favor of an independent steam brake.

Mr. W. H. Lewis said: There has been a great deal said about the injurious effect of the cam brake as applied to the wheel between the drivers. I am a little of the opinion that it is a kind of a bugbear. In my experience I never have seen any very injurious effects from the application of a cam brake. I never have known of an engine to go out of service from any injury that she might have received from the application of a cam brake between the drivers. I think myself that the outside brake is an advantage, particularly with a 10-wheel engine. You get a greater braking power than you would with a cam brake, because it is impossible to apply the cam brake to a six-wheel engine without the double system of brakes.

The Jewett Roller Center and Side Bearings.

Mr. L. K. Jewett, the inventor of the Jewett car truck, has lately patented a most valuable improvement in cars, which consists of roller arrangements which will make the center bearings and the side bearings susceptible of easy movement. The Jewett devices are so constructed and arranged that all rolls designed either for center plates or for curve plates have an absolutely free movement, while they are kept in perfect alignment and operate harmoniously.

The curve plates are placed at a considerable distance from the center of the truck; therefore, when a car tips or sways when rounding a curve, the top curve plate is sometimes raised from off the curve plate rolls. Therefore, in order to overcome the liability of the rolls rolling out of their correct position, when they are thus relieved from pressure, they are provided with a simple and effective style of gearing, which, while permitting the rolls to have an absolute free movement, will always retain them in their correct position between the two curve plates, regardless of the swaying up of the top curve plate.

After obtaining an absolutely free movement, it was necessary that the rolls should be kept in alignment, as all rolls designed for either center or curve plates move in circular lines. This feature is accomplished by providing the rolls with a roll housing, the sole duty of which is to keep the rolls in absolute alignment. Having secured the absolute freedom of the rolls and also the absolute alignment, it only becomes necessary to provide a car with Jewett's devices to obtain the results eagerly sought for by all railroad officials and employés, namely: The easy riding of cars, especially around curves, combined with perfect safety. Obtaining these results, as a sequence, follows greater haulage capacity of locomotives, increased life of cars, trucks, wheels and rails.

It seems natural for a person who has not acquired skill in any operation to marvel at the ease with which another does something that appears difficult to perform. Looking on admiringly and wishing that we could perform operations requiring acquired dexterity is useless. What one can do another can learn if he is persevering enough to go through the training necessary. The difference between easy and difficult work was one day strikingly explained by the chief draughtsman of the Edison works at Shenectady. A graduate of a technical school who had been hired to do some drawing went to the man in charge, and asked if the work was difficult. "Well, young man," replied the chief, "if you don't know how to do it, it is difficult." The same thing applies to all work entailing developed skill.

Railway Car Construction.

BY WILLIAM VOSS.

Eighteenth Paper.—Continued.

SIDE FRAMES.—CONTINUED.

There are two more forms of side trusses to be mentioned; the Challender, or iron truss, Fig. 133, consists of an iron or steel plate of the same length as the car itself and corresponding in width to the distance between the floor and window sill. It is somewhat less than ¼ inch thick, and is attached to the posts with screws and to the sill with bolts, an angle iron being riveted to its lower edge for that purpose.

The truss in Fig. 134 embodies the same principle, but is of wood, and is located on the outside of the studding. It is nothing more than a course of very wide boards applied longitudinally and in a superior manner; the backs of the boards are accurately grooved to a depth of ¼ or ⅜ of an inch at every post, the joints being additionally strengthened by a liberal use of glue and screws. These boards are placed flush with the sill and belt rail, and the whole surface is carefully prepared to receive the paneling, which is glued to it, in addition to receiving the usual number of nails and screws.

The strength of all the different side trusses, excepting the Challender, is materially added to by the truss plank. This is located and applied as shown in the preceding sketches, but more particularly in the cross-section, Fig. 134. To be most effective, it should extend the whole length in one piece, be from 2 to 2½ inches thick, and as wide as the seats, for which it is utilized as a support, will permit. It is secured to the sill with ½-inch bolts placed at intervals of about 3 feet, and to the studding with two ⅜ or ½-inch lag screws in each.

The side frames of baggage cars or all those having only a limited number of windows, if any at all, are arranged slightly different from the above. Fig. 135, which represents the frame of a combination baggage and mail car, of which Fig. 101 of a preceding paper is the plan, will serve as an example, other styles differing from this in the details only and not in the general arrangement. The posts are set at intervals of about 24 inches when their location is not determined by the door and window openings; their size is 1½ × 3½ inches. The nailing strips, of which there are four, are of the same size and are applied in the same manner as the panel rails of passenger cars. The braces which are 1½ inches thick and from 5 to 7 inches wide, according to location, are let in flush with and fastened to the inner edges of the posts in the same manner as the railing strips are on the outside. To guard against the posts in contact with the ends of the braces from being crowded out of place by the thrust of these, they are in this case let into both sill and plate to a depth of ⅜ of an inch, excepting where the pressure of one balances that of another, as at the base of the transom post.

The sill and plate rods, like the braces, vary in size; those at the corners are ⅝ of an inch; all other carrying rods ⅝, and those simply acting as ties are ½.

A change in the location or in the number of doors and windows in cars of this kind alters the disposition of the braces, but does not materially affect the other parts. A door at or near the body bolster should always be avoided if possible, because that portion of the frame requires bracing the most. In cars with three compartments it is, however, impossible to place the mail doors different; but as these are comparatively narrow and need not extend down to the floor, they may be located directly over the bolster, in the space between the two braces extending from this, as in Fig. 136. This sketch shows the side frame of the car represented by floor plan, Fig. 102, and is introduced here as an example of the combination of a passenger car with a baggage car frame. No new features that require a special description are introduced.

END FRAMES.

The prominent parts of the end frame are the corner and door posts, the former being, however, as much a part of the side as they are of the end frame. Both are shaped in the form of a quarter circle, the radius of which is usually 5½ and 5 inches, respectively. Their exact form and the manner in which they are applied is shown in Fig. 137, which is an end view and section of the frame Fig. 129. The corner post is framed to the plate with a tenon, but is secured to the sill with screws only; the supplemental posts, however, which are so securely attached to it with both glue and screws, so as to make the whole practically one piece, have tenons at the lower ends also. A lintel of the same circular section as the door posts themselves, and usually also of wood, although cast-iron arches are sometimes used, connects these at the top and forms in the example a rectangular opening with slightly rounded corners. The top of the door opening is also frequently a semi-circle, elliptic, or perfectly straight, with sharp corners, the latter mostly for both the end and side doors of baggage and kindred cars, it being in that case often nothing more than a piece of board covering the lower edge of the plate.

The studding and belt and panel rails are the same as those at the sides, although the former are perhaps 1 or 1½ inches narrower when end windows are omitted, as is the case in sleeping cars and frequently in day coaches also. The braces are in that case—that is, if braces are introduced at all to stiffen the frame—longer and extend to the angle formed by the junction of the door post with the plate.

The end plate is usually 2½ or 3 inches thick and from 15 to 17 inches wide in the center; this last dimension being governed by the pitch of the rafters, which also determines the outline to which the upper edge is shaped. The plate is secured to the side plate and deck sills with joint bolts and to the end sill with four ⅝-inch tie rods, located as shown.

ROOF FRAMES.

By far the largest majority of passenger cars have a clear-story or upper deck, as it is more commonly termed. This has been established so long and its utility for purposes of ventilation and light is so pronounced, that it will probably remain to be one of the prominent features of the American cars. The arched roof introduced into this country with the Mann boudoir car some years ago is the only other roof used for passenger cars; but it is used to such a limited extent only and its construction is so simple that it need not be considered in this paper.

The outlines, dimensions and manner of framing the roof and clear-story as usually constructed are illustrated in Figs. 129 and 137. The clear-story or deck side is composed of a sill and plate, and posts separating these; all three members are usually 2 or 2½ inches thick and 6, 3½ and 4 inches wide, respectively. The posts and ⅝-inch tie rods passing through these correspond in number and location to the side window panels, there being as many deck as there are side windows. The rafters which form the connection between the deck sill and side plate are 1½ inches thick, about 5 inches wide at the lower end, 2½ inches at the upper end; both edges are curved to a given radius or shaped to whatever other outline the fancy of the designer may select. The rafters are attached to the plate with two large screws in each and to the deck sill with a pinioned tenon or a tenon and a small joint bolt; they are spaced about 18 inches from centers, when this is practicable—in a day car there is one to every window and panel. The deck carlines, which are spaced to correspond with the rafters, are 1½ × 2 inches, and are also curved, but to a much larger radius.

An iron carline is introduced every 6 feet, or at every second panel, for the purpose of strengthening the roof vertically. It is a flat bar of ⅝ or ¾ × 2-inch iron set on edge and bent to conform to the contour line of the roof and deck; the ends are bent at right angles where they meet the plates, and are attached to these with two ½-inch bolts in each. The iron, or compound carline, as it is designated, because it is attached to the sides or between the wooden rafters and deck carlines, is placed flush with the upper edges of these, but the vertical portions project from the deck sides the full width of the iron; to let them

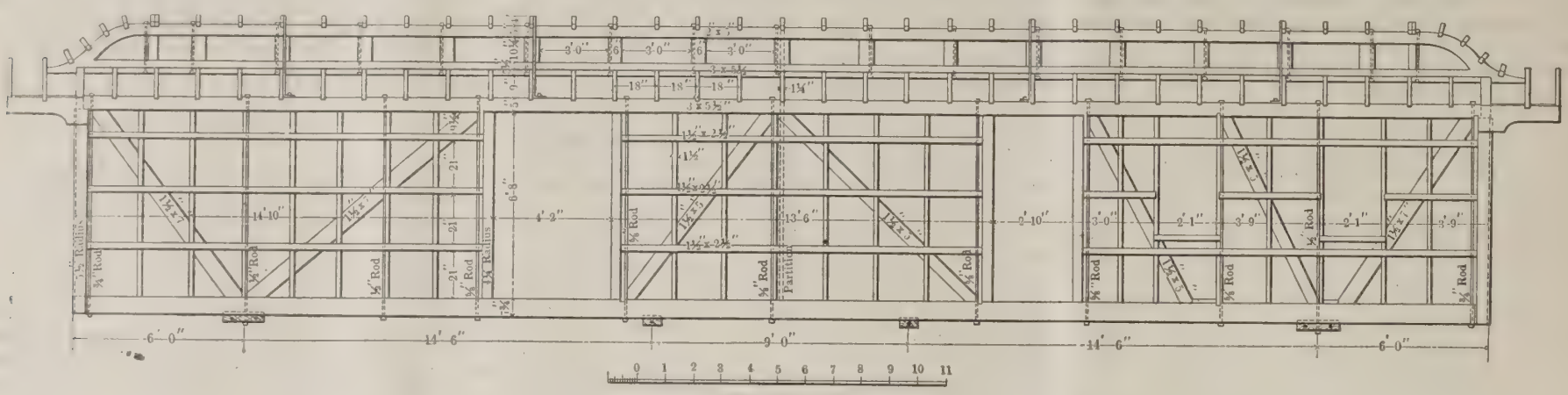

Fig. 135

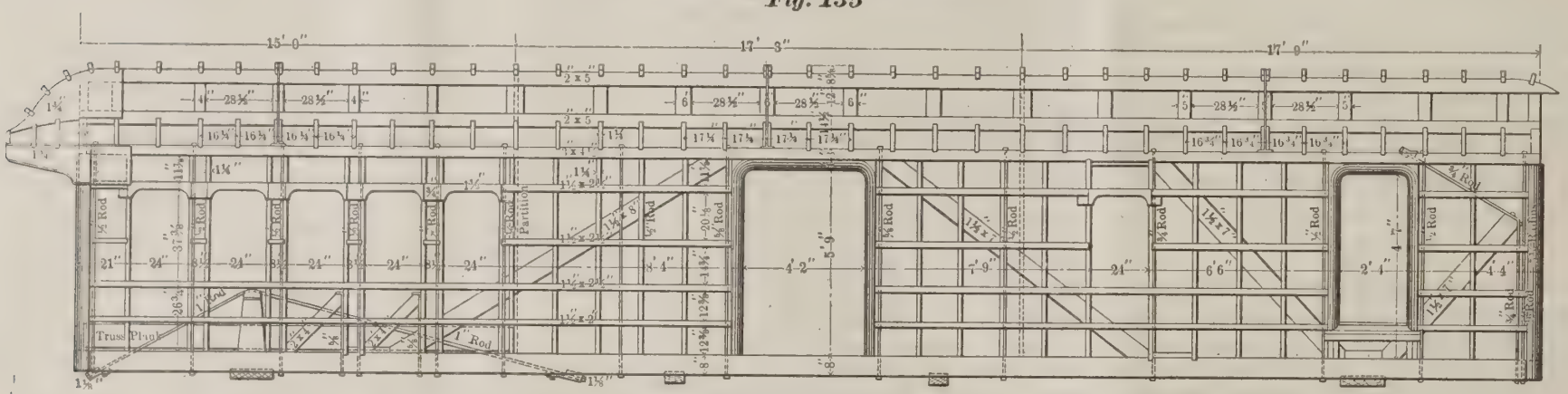

Fig. 136

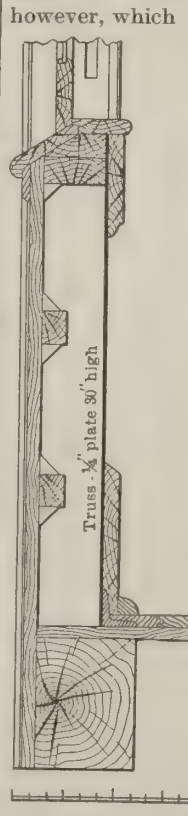

Fig. 133

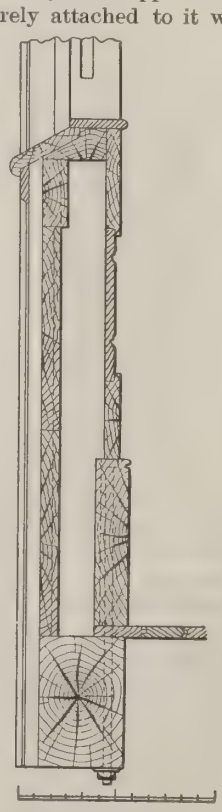

Fig. 134

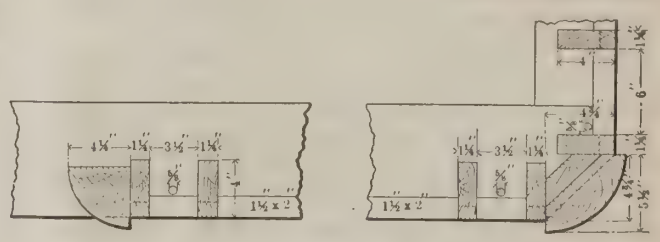

Fig. 137

in flush would cut in two both the sill and plate. The projections are, however, not objectionable, because they are usually hidden by the deck screens.

The construction of the roof end, or platform roof, depends somewhat on the design of outline selected. Referring again to Figs. 129 and 137, which show a side and end elevation, respectively, of the platform roof used most, the principal members are the side and deck brackets and the end carline. All of these are sawed and shaped to the exact form required from 1¼-inch surfaced planks of yellow poplar. The side bracket is a continuation of the letter board, and its exterior is therefore placed flush with this; it is securely attached with screws and nails to the corner and other posts it comes in contact with; the deck bracket is similarly attached to the sides of the deck sill and plate. To avoid cross grain, the end carline is composed of two separate pieces, the two sections being connected at the center with a glue joint; it is supported by and fastened to the ends of the four brackets described above with screws, and in some cases in addition to this with light iron knees. In this instance the intermediate supports for the deck roof are placed vertically, because this allows the boards to be applied in a direction that requires the least amount of bending; in many cases, however, they are placed across the frame like deck carlines. The intermediate rafters which connect the side with the deck brackets are always applied as shown.

Numerous other styles of platform hoods are in existence, but only two more are shown, and these in elevation only in Figs. 135 and 136.

Notes from Uruguay.

The following are extracts from a letter written by our correspondent, Mr. George H. Baker, who left the Chicago, Burlington & Quincy some months ago to take the position of master mechanic of a railway in Uruguay, South America. The letter was written at Montevideo, April 7.

Well, we had a good safe trip, without even an approach to any serious accident. After a rough passage from New York to Liverpool, and from Southampton to Lisbon, and a smooth and pleasant passage from Lisbon, we arrived here on the 13th of February. We were eight days from New York to Liverpool, and 28 days from Southampton to Montevideo, making 36 days on the water.

I find Montevideo a city of about 175,000 people, situated about thirty miles inland from the mouth of the Rio de la Plata, and on a neck of land about two miles broad, extending into the river. The city is well laid out with straight, well paved, and reasonably broad streets and sidewalks. The streets are lighted by electricity. Gas and hydrant water are used all over town. American-built street cars run on all the principal streets and to all parts of the town. The people are generally as well dressed, and apparently as well to do as the people in our own cities. It has not been unpleasantly warm here since I arrived, and I am told by the people who live here that it does not get much warmer, and that the nearest approach they have to ice in winter is a film that disappears as soon as the sun rises.

I have seen but little of the country, but judging from what I have seen and heard, I believe it is a rich country naturally, and capable if properly developed of a bright future.

But, unless they greatly alter, the natives will never catch up with the procession. They are a lazy, ignorant set, who appear to have no higher aim in life than to exist with the least possible effort. This is the land of little work; the land of beggars on horseback, *really*. Milk and butter, here in a land covered with herds of cattle, are hard to get, and in most localities are considered such troublesome luxuries that they are not to be had. What little butter is brought to the city for sale is churned on its way to town by being packed on the backs of trotting horses in cans. The people of the city are of a somewhat better class, but have many qualities that forbid esteem.

The money is decimal, at par with gold, and is worth about three cents more on the dollar than United States money. Living is expensive. Nearly every item that goes to make up the expense of living is twice as expensive as in the United States.

There are three railroads running into Montevideo, one with 60 locomotives. Nearly everything about the railroads is English. Coal costs about twelve dollars per ton and is the fuel used for all purposes. The following prices are the highest for labor:

Laborers, $1.00 to $1.20 per day; common workmen, $1.30 to $1.50 per day; carpenters, $1.80 to $2.00 per day; smiths, $1.80 to $2.00 per day; machinists, $2.00 to $2.50 per day; boilermakers, $2.00 to $2.50 per day; masons, $2.00; engine runners about $70 per month; engine firemen, about $50 per month.

From this it will be seen that Uruguay is a poor place for any American workingmen to come to for work.

There are many English workmen here, but generally they are much poorer and less trustworthy workmen than the Italian and Spanish workmen are.

On arriving here I found nine Baldwin engines, all in pieces and packed in cases, and the pieces for erecting fifty gondola and ten box cars. I have erected twenty gondola cars and, within the last two weeks, one locomotive. By the time this reaches you I expect to have forty gondola cars up and several locomotives. Although the cars and engines were all in pieces, I have experienced no trouble in putting them up with native help.

Two Locomotive Celebrities.

Last summer the writer enjoyed the pleasure of visiting two pioneers of locomotive engineering. Near Charing Cross, London, extending from the noisy Strand toward the Thames embankment, is Buckingham street, a narrow street with ancient, sleepy-looking dwellings nodding to each other across the way. Here we searched for No. 8, and after climbing a flight of tortuous stairs found admittance to a small book and paper limbered suite of rooms where we found a venerable, pleasant-faced, studious-looking gentleman who acknowledged in reply to our inquiry that he was Mr. Daniel Kinnear Clark. Mr. Clark is a mild, soft-speaking Scotchman, who displays a wonderful acquaintance with current events connected with railway machinery in all countries. He appeared to be as familiar with what was going on in America as he was with English railway affairs.

Mr. Clark became famous forty years ago for the great variety of experiments he made to ascertain data about the working of locomotives. The accuracy of his deductions was simply wonderful, and much of the information which he propounded about proportions is recognized authority to-day. His book on Railway Machinery, published in 1851, became authority with the railroad men of all countries at once, and it has been a quarry from which many subsequent writers on locomotive subjects have drawn the inspiration that gave them engineering reputation. About the time his first book was published, Mr. Clark left the Great North, of Scotland, where he was locomotive superintendent, and devoted his attention entirely to engineering and to engineering literature. When we visited him he was engaged on the proof-sheets of a book on the steam engine, which is now on the press.

To Arbroath, a busy manufacturing town on the north-east coast of Scotland, famous in mediæval times as the seat of a great abbey where King Robert Bruce was buried, we made a pilgrimage for the purpose of visiting Thomas R. Yarrow, the inventor of the smoke-preventing arrangement of a brick arch, the first successful smoke-preventing device applied to a locomotive, and, for that matter, the only one worth putting on.

We found Mr. Yarrow, who must now be well on to four score years of age, a hale and hearty Englishman, active, sprightly and a little tempestuous in action and talk. About twenty-five years after the Rocket astonished the world by the speed of her first run, the railway companies of Great Britain discovered that coke, then used exclusively, was a most expensive fuel, and that great saving would be effected if coal could be used successfully. There was no difficulty about getting coal to generate the steam required, but the laws were very stringent against smoke raising, and the prevention of smoke while burning coal in locomotive fireboxes was a scientific problem that engaged the attention of the ablest engineers and scientists of Europe. At the time this problem was receiving most attention Mr. Yarrow was locomotive superintendent of the Scottish Northeastern Railway, with headquarters at Arbroath. While other inventors were loading down fire boxes with complex apparatus expected to lead to the combustion of the volatile gases, Mr. Yarrow applied a brick arch made of common small fire brick, and provided the means of admitting air above the fire. The invention was a success, and has saved millions of pounds to the railway companies of Europe. Yarrow's invention, brought out thirty years ago, is the most successful smoke-preventing apparatus ever applied to a locomotive, and nothing better is needed to-day if it is supplemented by the attention of a careful fireman.

The Indicator on Locomotives.

There is one point in connection with the use of the indicator on the locomotives which we are persuaded is quite too frequently overlooked. It is too often forgotten that the boiler and the furnace are inseparable parts of a locomotive engine, and that, owing to this fact, it frequently happens, and, indeed, is usually the case, that what would be nearly the ideal indicator diagram for a stationary engine would indicate poor results for a locomotive having the same size cylinders, and doing the same amount of work at the same initial pressure and speed.

The performance of a stationary engine in no way affects the economical performance of the boiler which supplies it with steam, and an indicator diagram from such an engine merely shows the performance of the engine only; indicating, among other things, the pressure at which steam is admitted to the cylinder, regardless of whether that pressure is economically or wastefully maintained in the boiler, the manner of using the steam in the cylinder having no effect whatever upon the economical combustion of fuel in the furnace.

With the locomotive the conditions are essentially different, because the exhaust is depended upon for the blast by which the fuel is burned and the steam kept up It thus frequently happens that a diagram which would delight the eye of the indicator man, and which would represent to him the very acme of efficiency in that type of engine, would break the back of the locomotive fireman, and cause the engine to die on the road for the lack of steam. On the other hand, a diagram which, considered by itself, and solely with reference to the economical use of steam in the cylinder, would be considered a very poor one, might prove in practice to be the one giving the best economy by actual weighing of coal consumed. It may be said that for every cylinder of given dimensions, and having steam supplied to it at a given pressure, there is a certain distribution of steam which is the best one for that cylinder when doing the given amount of work. This distribution will be shown by an indicator diagram, which will represent the ideal conditions for that engine and for that work. But if the engine is a locomotive engine, the effect of the exhaust upon the fire must be taken into account, and there are many things about the boiler and fire-box, and in the front end, which may have an effect on the character of the exhaust required to give the best results. The kind of coal used, the form of the grate-bars, the size and number of flues, the diameter of exhaust nozzles, or the variation of an inch in the height of the petticoat pipe, may materially alter the character of the blast needed to produce the most efficient combustion of fuel; and, as this blast is furnished by the exhaust steam, the steam distribution and the indicator diagram representing the best possible performance will be correspondingly modified. This, of course, is no argument against the use of the indicator on locomotives, but should serve as a reminder that the indicator, like everything else, should be used only for the purpose for which it is adapted, and it certainly was never intended for the indication of boilers or fire-boxes. The use of the indicator has in the past been confined mainly to engines in which the exhaust has no direct effect on fuel consumption, and the theory of the indicator has been developed by such use of it. Those who propose to use it in locomotive practice must make the proper allowances for the different conditions, and failing to do so they should not blame the indicator, and declare it to be a humbug because they fail to get satisfactory results from it.

This is a matter too frequently ignored; it should always be remembered that the best indicator diagram from a locomotive is in the nature of a compromise between the cylinders and the boiler.—*American Machinist.*

Civility is Cheaper than Rudeness.

A soft answer turneth away wrath is a very wise old saying that a good many railroad officers might with propriety have posted up where their attention would be often attracted to this ancient injunction to good manners. The truth of this was forcibly impressed upon me lately when I happened to be visiting in the office of a superintendent whose upward career I had been familiar with. He is really a kindly man at heart, but he is of a rough exterior, and withal a little pachydermous. While I was there a man came in and asked for work as a brakeman. He was not told civilly that no brakemen were wanted. He was informed in a very rude and preemptory way that such applications were a blank annoyance to the head of the office, and that a class of loafers were bothering superintendents by pretending to be brakemen. The applicant was a very meek man if he did not go away bearing a grudge against that superintendent and against the company.

The incident brought to memory an experience of my own that was very galling at the time, and for years stirred within me feelings of indignation.

When business was still suffering from the depression that followed the panic of 1873, I left a job in an Eastern locomotive building shop, and went West to grow up with the country. It seemed to me that a machinist and locomotive engineer could not go far in the West without finding some one ready to give him work. The search proved far more prolonged than I had anticipated, and numerous towns were searched with the discovery that all the shops were full-handed. After disappointments too numerous to mention, and when hope deferred was making the heart sick, and evaporating the forces of courage and perseverance, I reached Jackson, Mich., and made application for work at the office of the general master mechanic. The master mechanic received me kindly, and having asked where I had worked, expressed the belief that I might get work by applying to the general foreman. This proved to to be S. H. Edgerly, who afterward had a brief but not eventless career as master mechanic of the Michigan Central. He questioned me at great length about the time it would take me to do certain jobs, and expressed in very forcible language his contempt for the kind of machinists who come from locomotive contract shops. By some means he drew out of me the admission that I was a locomotive engineer.

"When you get acquainted here," he said, in a remarkably softened voice, "I suppose you will try to get on the road running?"

I meekly answered that nothing would suit me better.

"Well," he roared, "get out of here. I don't want any son of a blank of an engineer in my shop." The word engineer appeared to act on him as a red flag is said to influence a savage bull, and he shouted abuse as long as I was within the sound of his voice.

Mr. Edgerly probably did me a good turn by refusing to give me work, but nevertheless his conduct was outrageous. He has now found his natural level of a common workman, and it reflected little credit on those whose want of discrimination was the means of placing him in a little brief authority, which was scandalously abused. MAC.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Tenth Paper.

FOUR-CYLINDER COMPOUND LOCOMOTIVES.

Tandem Engines.—The problems to be solved in connection with the steam distribution in compound engines in which the pistons move simultaneously are in some respects quite different from those which are encountered in the design of compound receiver engines. The tandem arrangement is one form of what are frequently called Woolf engines, or continuous expansion engines, the distinctive feature of the class being that the pistons move simultaneously, and that there is no receiver. In the simplest forms of this type, as applicable to locomotives, the high- and low-pressure pistons are attached to the same piston rod, and the slide valves of both cylinders are operated by the same link motion. The peculiarities of the steam distribution in this arrangement of cylinders can be best examined by means of theoretical indicator cards, such as Fig. 45. Referring to this figure, *a*, *b*, *d*, *e*, *f*, *g*, *h*, *k*, *a* is the high-pressure card, and *g*, *h*, *l*, *m*, *n*, *q*, *g* is the low-pressure card. In the high-pressure cylinder cut-off takes place at *b*, and there is expansion in that cylinder until the exhaust opens at *d*. There is then a drop in pressure to *e* as the steam in the high-pressure cylinder mingles with that in the passages which connect the cylinders. From *e* to *f* there is further expansion in the high-pressure cylinder and the connecting passages. At *f* the low-pressure steam valve opens and there is another drop in pressure to *g*. From *g* to *h* the cylinders are in communication, and there is expansion until the low-pressure steam valve closes at *h*. From *h* to *k* there is compression in the connecting passages and the high-pressure cylinder, and when the high-pressure exhaust closes at *k* there is further compression in that cylinder. In the low-pressure cylinder the steam expands from *h* to *l* where release occurs and the pressure drops to the ordinary back pressure line.

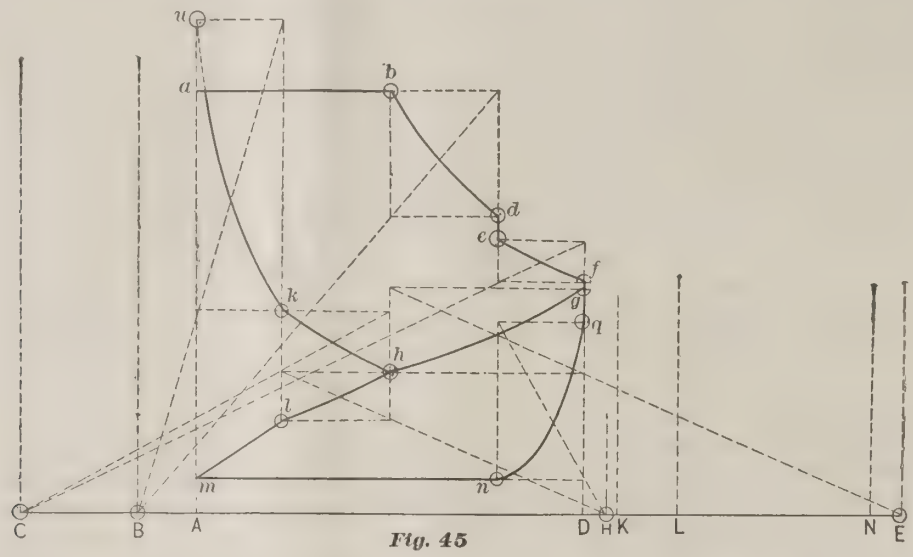

Fig. 45

The features of this diagram which require special attention are the losses in pressure at *d* and *f* and the compression in the high-pressure cylinder. In order to prevent the drop at *d*, either the pressure in the connecting passages when the high-pressure exhaust opens must be the same as that at *d*, or else the volume of the connecting passages must be practically nothing. The former result can possibly be obtained by adjustments of the low-pressure cut-off, but it is not practicable on account of the unavoidable complications. The only feasible method of reducing this loss to an inappreciable amount appears to be to make the volume of the connecting passages very small compared with that of the high-pressure cylinder. The drop in pressure at *f* can be prevented or reduced by compressing to the pressure *f* in the low-pressure cylinder, or by making the low-pressure clearance very small.

The question of compression in the high-pressure cylinder in this type of engine is even more troublesome than in receiver engines. In order to avoid compressing to a higher pressure than the initial pressure with the usual forms of valve gear, it is necessary that the volume of the high-pressure clearance space should be made large, since the pressure at *k*, where the compression caused by the exhaust closure begins, is unavoidably high. This pressure can of course be somewhat reduced by making the volume of the passages connecting the cylinders large, but, as has been shown, this involves a considerable drop in pressure at *d*. The expedient of giving the high-pressure valve inside clearance may also be employed in connection with a large clearance space to assist in keeping down the compression. In any case in which the shifting link motion is used early cut-offs are to be avoided, both on account of this compression and to avoid the wiredrawing which results from a small port opening.

It is, however, not necessary to resort to very early cut-offs in order to obtain a sufficiently great expansion, as this may be secured by using a comparatively large cylinder ratio. If, for example, we assume a cylinder ratio 3 and a boiler pressure of 160 pounds, a final pressure of about 2.5 pounds above the atmospheric pressure can be secured with a cut-off in the high-pressure cylinder at three-tenths of the stroke at slow speeds, and at high speed a later cut-off would be necessary to maintain the same terminal pressure.

In determining the proportions for the valve gear and the size of the cylinders advisable for a tandem compound which is intended to take the place of an ordinary locomotive, the most satisfactory mode of procedure will be to construct theoretical indicator cards, using the term as we have heretofore, for various points of cut-off, measure the area of these cards or calculate them by the formulas already given in discussing the theory of two-cylinder receiver engines, and finally to adjust or "doctor" the cards for losses, as experience with ordinary locomotives has shown to be necessary. An example of indicator cards constructed in this way is given in Fig. 45, on a much smaller scale, however, than is advisable in practice. The assumed data in this case are as follows: Initial pressure, 175 pounds absolute; cylinder ratio, 3; low-pressure back-pressure, 17 pounds absolute; cut-off in both cylinders, 0.5; release and compression in both cylinders, 0.78; volume of high-pressure clearance, 15 per cent.; volume of low-pressure clearance, 6 per cent.; volume of connecting passages, 0.3 of high-pressure cylinder. The scale of pressures used in the diagram is 80 pounds to the inch. For the benefit of those who may wish to construct such diagrams we will follow through this case in some detail.

The following symbols will be used:

v = volume swept by high-pressure piston.
V = " " " low-pressure "
c = " of high-pressure clearance.
C = " of low-pressure "
i = " of intermediate or connecting passages.

The volumes occupied by the steam at the several lettered points on the diagram are, then,

At b, $= .5\ v + c = .65\ v$.
At d, $= .78\ v + c = .93\ v$.
At e, $= .93\ v + i = 1.23\ v$.
At f, $= v + c + i = 1.45\ v$.
At g, $= 1.45\ v + C = 1.63\ v$.
At h, before cut-off, $= .5\ v + c + i + C + .5\ V = 2.63\ v$.
At h, in l. p. after cut-off, $= .5\ V + C = .56\ V$.
At h, in h. p. and passages after cut-off in l. p., $= .5\ v + c + i = .95\ v$.
At k, before valve closure, $= .22\ v + c + i = .67\ v$.
At k, in h. p. after valve closure, $= .22\ v + c = .37\ v$.
At l, $= .78\ V + C = .84\ V$.
At n, $= .22\ V + C = .28\ V$.

The pressure at *d* and the curve between *b* and *d* may be found by constructing the curve through *b* with *B* as the origin, *A B* being .15 of *A D*; or by calculation as the pressures may be taken inversely as the volumes, whence pressure at $d = 175 \times .65 \div .93 = 122.3$ pounds. The drop in pressure from *d* to *e* depends upon the pressure at *k*, that in turn depends upon *h*, and so upon *g*. The pressure at *g* depends upon that at *q* and at *f*, and so upon *e*. In any case, there is but one pressure at *h* which will fulfil the conditions, and that pressure must be determined by calculation. Assuming for the moment that we know the pressure at *e* to be 112.5 pounds, the pressure at *f* will be $112.5 \times 1.23 \div 1.45 = 95.4$ pounds. The pressure at *g* is determined by the mixture of the volume at *f* at 95.4 pounds with the volume of the low-pressure clearance at pressure *q*. To find the latter we have pressure at $q = 17 \times .28 \div .06 = 79.3$ pounds. Then pressure at $g = \frac{79.3 \times .18 + 95.4 \times 1.45}{.18 + 1.45} = 93.7$ pounds.

The pressure at $h = 93.7 \times 1.63 \div 2.63 = 58.1$ pounds. The pressure at $k = 58.1 \times .95 \div .67 = 82.3$ pounds. We can now find the pressure at *e* which is

$$\frac{122.3 \times .93 + 82.3 \times .3}{.93 + .3} = 112.5.$$

By combining these various expressions for pressures we can readily form a single equation from which the pressure at *h* can be calculated, which is, in fact, the method by which it was determined in this case.

Having found the pressures at *e*, *g* and *h* by calculation, the various curves of the diagrams can be readily constructed. For the curve between *e* and *f* a point *C* is used for the origin, which is found by laying off *B C* equal to .3 of *A D*. The curve *h k* is constructed from the same origin. The compression curve *k u* is laid off from *B*. To find the origin for the curve *g h*, we proceed as follows: At *g* the steam occupies the volume $v + c + i + C$, and at *h* the volume occupied is $.5v + c + i + C + (.5V = 1.5v)$. The increase in volume is therefore equal to *v*, and therefore the scale of this part of the diagram must be such that the horizontal distance from *g* to *h* represents *v*, the volume of the high-pressure cylinder. With this scale of volumes lay off $D K = .06V = .18v$, $K L = .3v$, $L N = v$ and $N E = .15v$; then *E* is the origin from which to construct the curve *g h*. For the curves *h l* and *n q* the origin is taken at *H*, which is found by laying off $D H = .06$ of *A D*, which for these curves represents the volume of the low-pressure cylinder.

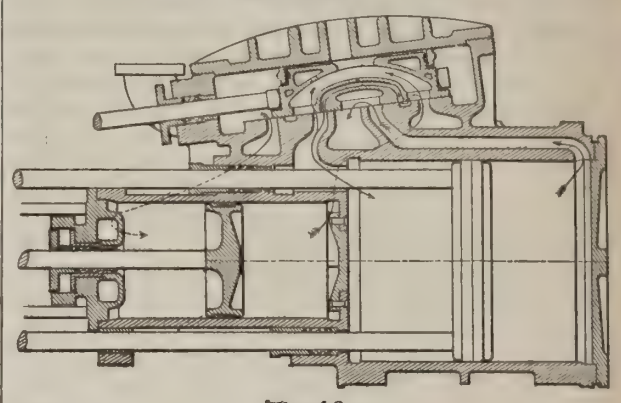

Fig. 46

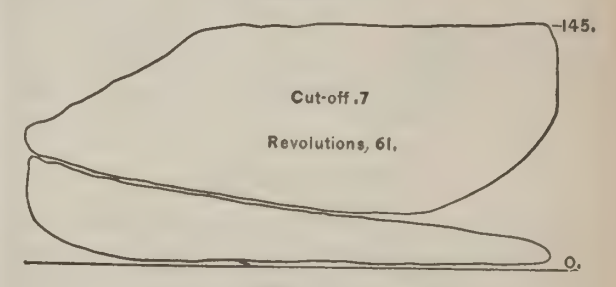

Fig. 47

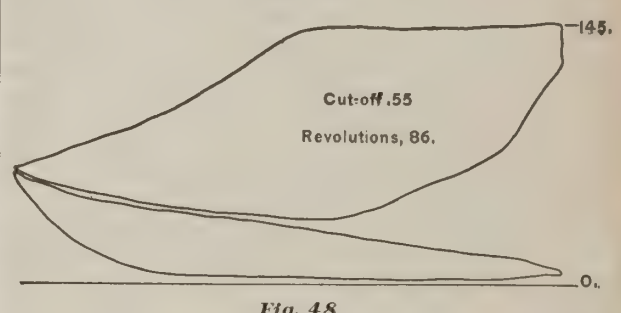

Fig. 48

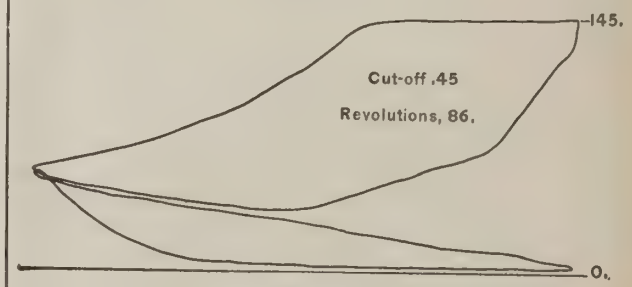

Fig. 49

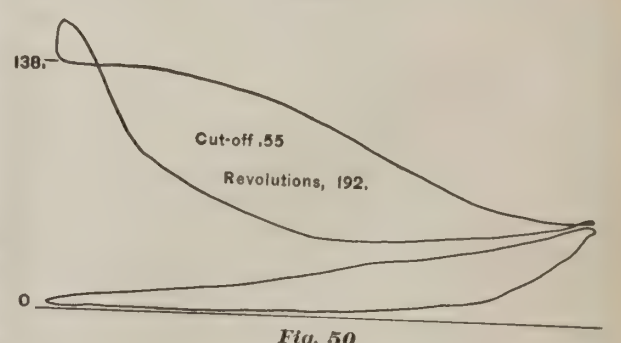

Fig. 50

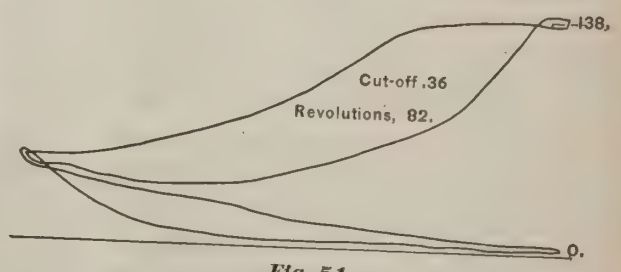

Fig. 51

This diagram illustrates the difficulty of keeping the high-pressure compression within reasonable limits. The exhaust closure at 0.78 when cutting-off at .5 is approximately that obtained with the valve gear, of which the distribution was shown in tabular form in the Third Paper. The valve has 0.25-inch inside clearance, and there is 15 per cent. cylinder clearance. But the pressure at *k* is 82.3 pounds, and the pressure at the end of the compression *u* will therefore be $82.3 \times .37 \div .15 = 203$ pounds absolute,

*Copyright, 1889, by Arthur T. Woods.

or 28 pounds above the initial pressure. To overcome this difficulty it will probably be necessary in most cases to make use of a combination of inside valve clearance, large cylinder clearance and considerable lead.

As a first approximation in determining the size of cylinders the following method may be used. Assume, for example, that a tandem compound is to be substituted for an 18 × 24 simple locomotive, the same boiler pressure of 160 pounds to be retained. With a cut-off at seven-eighths of the stroke, and 160 pounds initial pressure, the mean forward pressure in the high-pressure cylinder will be 173.3 pounds absolute, and the final pressure in that cylinder will be 153.1 pounds absolute. We may assume a drop in pressure of about 5 pounds between the cylinders on account of resistance of ports, etc., so that the initial pressure in the low-pressure cylinder may be taken at 148 pounds. With a cylinder ratio of three, the steam which now fills the high-pressure cylinder and the low-pressure clearance will be expanded to about three times its present volume, and the mean forward pressure in the low-pressure cylinder will be 81.3 pounds absolute. These mean pressures are calculated by the formulas already given in discussing the theoretical distribution in two-cylinder receiver engines. The low-pressure back pressure may be taken at 17 pounds absolute, which gives 64.3 pounds for the mean effective pressure in the low-pressure cylinder. For our present purposes we will take the mean high-pressure back pressure as five pounds above the mean low-pressure forward pressure, which will give a mean effective pressure in the high-pressure cylinder of 173.3 — 86.3 = 87.0 pounds. If the maximum mean effective pressure which can be developed in the cylinders of the simple locomotive be taken as 155 pounds, we will have, in order that the maximum work of both engines may be the same, assuming that the stroke is the same in both, $87.\ a + 64.3 \times 3\ a = 155 \times 254.5$, in which a is the area of the high-pressure piston and 254.5 is the area of the 18-inch piston. From this equation we find $a = 140.9$ square inches, from which the area of the low-pressure piston is 422.7 square inches. The corresponding diameters are approximately 13.4 and 23.2 inches.

In the above approximate calculation, the effects of early exhaust opening, clearance, compression, and low-pressure cut-off have been neglected, and it will be apparent that a calculation in which these factors were duly considered would be very laborious. But knowing the approximate dimensions of the cylinders the design can be sufficiently completed to determine the volume of ports, passages, etc., and accurate indicator diagrams can then be constructed, by the method already given, by which the final dimensions for cylinders and valves can be determined.

The starting power of a tandem compound locomotive, having cylinders of the dimensions given above, will be about the same as that of the simple 18 × 24 locomotive, when steam at about 82 pounds absolute pressure is admitted directly to the low-pressure cylinders. The steam so admitted acts as forward pressure on the low-pressure pistons, and as back pressure on the high-pressure pistons, so that the locomotive may be said to start as a compound engine. There would, therefore, be no advantage in keeping the starting valve open after the first exhaust from the high-pressure cylinder had taken place. But there is another view of the question of starting which should be noted. If full boiler pressure were admitted to the high-pressure cylinder by the main steam pipe, and the same pressure to the low-pressure cylinder by means of the starting valve, the high-pressure piston would be practically thrown out of action, and the starting power would depend simply upon the area of the low-pressure piston. Therefore, if this piston were but 18 inches in diameter, the possible maximum starting power would be equal to that of the simple engine. Such an engine as this would be deficient in power as a compound, while with an engine having cylinders proportioned for the maximum pressure, as already given, it might be necessary to employ earlier cut-offs for ordinary work on a level than are advisable.

It is probable that the best dimensions for cylinders will be found to be those which will permit the engine to do the greater part of its work at cut-offs of from .4 to .5 in the high-pressure cylinder. It is evident that the only starting gear necessary is an arrangement by which steam can be admitted directly to the low-pressure cylinder for a short time in starting.

A successful application of the tandem form of compound engine to a locomotive has been made by Mr. G. Du Bousquet, of the Northern Railway of France. A detailed description of this locomotive is given in the *Revue Générale des Chemins de Fer* for November, 1888, from which the illustration and indicator cards which follow have been taken. This locomotive is a eight-coupled outside connected engine, all of the weight being on the driving wheels. It was originally a simple locomotive, having cylinders 19.68 inches in diameter by 25.59 inches stroke. The boiler pressure of 142.2 pounds, gauge, is the same as before converting it. The principal dimensions of this locomotive are as follows:

Diameter of high-pressure cylinders	15 inches
" " low-pressure "	26 "
Stroke of pistons	25.6 "
Diameter of driving wheels	51.2 "
Total weight, all on driving wheels	113,970 pounds
Area of grate	22.4 sq. ft.
Total heating surface	1,356 " "

The changes in the distribution and amount of the weights on the axles on account of converting are given as follows:

	Simple.	Compound.
First axle	26,900	29,670
Second axle	24,470	31,390
Third axle	26,670	30,820
Fourth axle	20,500	22,090
Total	98,540	113,970

To balance the increased weight of the cylinders a foot board weighing 6,600 pounds was put in. Fig. 46 illustrates the arrangement of the cylinders and valve chest, and is worthy of careful examination. It will be seen that the steam distribution for both cylinders is controlled by one valve, the low-pressure valve being, as it were, inside of the high-pressure valve. The arrows clearly indicate the paths of the steam. The principal dimensions relating to this valve gear are as follows:

Travel of valve		6.22 ins.
Steam lap, both cylinders, front		1.34 "
" " " " back		1.22 "
Exhaust lap, high-pressure		0.00 "
" " " low-pressure		0.32 "
Ports, high-pressure steam	17.72 ins. ×	1.38 "
" low-pressure "	17.72 " ×	1.97 "
" " " exhaust	17.72 " ×	3.51 "
Angular advance of eccentrics		30 deg.
Clearance, per cent. of cylinder volume h. p.		15.4
" " " " " " l. p.		7.0
Volume of connecting passages, per cent. of h. p. volume		16.5

The features of this design which are specially noteworthy are that the dead space between the cylinders is reduced to a minimum, the high-pressure clearance space is large, and that there are no bushings between the cylinders, but instead there are outside stuffing boxes which are easily accessible.

The indicator cards shown by Figs. 47 to 51, inclusive, illustrate the steam distribution in this locomotive. The effect of piston speed upon the distribution is well illustrated by Figs. 48 and 50, which were taken at the same nominal point of cut-off, but as the two pairs of cards are apparently from opposite ends of the cylinders, it is probable that the great increase in compression shown in Fig. 50 is partially due to irregularity in the valve motion. The mean pressures in these diagrams and the percentage of the total work done in the high-pressure cylinder are as follows, the pressures being taken from the tables in the *Revue*, as previously noted:

	Mean pressure. H. p.	L. p.	Per cent. of work done in h. p.
Fig. 47	79.36	30.87	46.2
" 48	63.01	21.76	49.1
" 49	51.20	15.36	52.6
" 50	36.84	15.22	44.7
" 51	31.86	9.53	52.7

This locomotive has been carefully tested in comparison with a simple locomotive belonging to the same original class, and the results are recorded at considerable length in the issue of the *Revue*, to which reference has already been made. The compound hauled trains about 12 per cent. heavier than the simple locomotive, with a noticeable saving in fuel, while with trains of the same weight the saving in fuel, as reported by Mr. Du Bousquet, was from 13.5 to 25.8 per cent. The average of five tests is 21.9 per cent.

The Pullman Steel Car Company, of Pullman, Ill., have closed a contract with the Middlesborough Town (Ky.) Company, by which an immense steel car works will be erected at once. The Town Company grants 45 acres of ground for the works and subscribes for $200,000 of the company's stock. The company will employ about 2,000 men.

Converting Electricity into Heat.

Among the latest purposes to which sanguine inventors propose to apply the electric current is the cutting down of trees. This not going to be done by using the electric current to drive a cutting saw. That would be too mechanical. They propose using the electric current to maintain a wire at a white heat, and use the wire in this condition to burn itself through the wood. The scheme has originated in the brains of some Pittsburgh parties interested in felling lumber in regions that are difficult of access.

During a recent visit to Chattanooga we were shown an electric invention that appears to be a distant relative of the scheme for cutting down trees by means of a hot wire. An Englishman who claims to be a relative of Mr. F. W. Webb, locomotive superintendent of the London & Northwestern Railway, and appears to gain power by the claim, proposes to use electricity for generating steam in boilers, and trials have been made of an apparatus designed for the purpose. Wires are coiled round a filling of asbestos, the combination making up a plug about four feet long, which is pushed into a boiler flue. About twenty of these plugs are used for a twenty horse-power boiler. The wires form circuits in which the asbestos causes a superficial resistance. When the wires are conected with an electric dynamo, and a current of electricity forced through them, the wires get white hot, and impart the necessary heat to the boiler. That is the inventor's theory of how it will work. We are puzzled to see what will prevent the wire heated to incandescence from immediately oxidizing and burning up. But the inventors appear to have faith in some law of nature being suspended to make their visionary plans work successfully. The man in Chattanooga is trying to make the people believe that he has got the biggest thing in creation—in fact, a creation in itself. He insists in saying that with ten horse power of electrical energy converted into heat he can generate sufficient steam to supply a forty horse-power engine. This would be a very neat and convenient way of making something out of nothing. Those interested in the invention did not like to be told that they were working upon a perpetual motion scheme. The most surprising feature of the whole thing is that many sensible business men are ready to accept it as practicable and to manifest their faith by giving it financial support.

Excellent Letter File.

During a recent visit to the National Hollow Brake Beam Company's offices in Chicago we were very much struck with the convenience of a form of letter file in use that had been planned by Mr. E. B. Leigh, general manager of the company. The annexed table will enable our readers to understand the arrangement of the file. Mr. Leigh writes about it:

As you requested me when at our shops a short time ago, I take pleasure in inclosing a pencil sketch of the letter file I got up for use at our general office. It almost explains itself, but I will call your attention briefly to the advantages sought to be obtained.

Of course the value of a letter file of this character is not only to have the letters so distributed that they can be readily referred to, but also to avoid transferring as much as possible. By the arrangement shown here we have all of our correspondence classified and subdivided, the first 12 files being devoted exclusively to general correspondence. This, for our business, is a large file for that purpose and will cover a considerable period. The remaining four files of the first tier are devoted to correspondence from car builders, the first two being for general car builders and alphabetically divided from A to K and L to Z, the next two, marked "Special Car Builders," are devoted to the twenty car builders we do the most of our business with. The next tier of sixteen files is devoted exclusively to railroad correspondence, the indexes in these files all being specially arranged and adapted for this purpose. You will notice there are three files given to the letter C, one of them being devoted exclusively to railroads the initial word of which is "Chicago."

The first four files on the third tier, marked "Mail City Office" contain duplicates of all letters written from our city office. The remaining files are devoted to special purposes as indicated.

At the top of the letter file are arranged twenty transfer volumes, the whole constituting a letter file and case occupying one end of our vault.

I should have forwarded this to you sooner, but just after your visit was called home by a death in my family, and have only just returned. If I have not given you all the information you desire, kindly indicate it to me and I shall be pleased to furnish it. Yours very truly,

E. B. LEIGH, Gen. Manager.

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PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING..... .....NEW YORK.

ANGUS SINCLAIR, Editor.

JUNE, 1890.

Subscription.—$1.00 *a year for the United States and Canada; $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

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Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Diversity in the Size of Standards.

The engineering and railroad world has given the Master Car Builders' Association free and full credit for the valuable work performed in the interests of uniformity by establishing standard forms and sizes of the leading members of railroad rolling stock. In this respect the Master Car Builders' Association as a body has performed its full duty to the interests served by the members, but we are constantly receiving reminders that many of the individual members have been very lax in maintaining in their proper form and size the parts which have been made standard. At one of the meetings of the recent Western Railroad Club attention was directed to the threatened danger of multiplying the forms of the M. C. B. standard car coupler by producing couplers that do not conform with accuracy to the standard lines, and by introducing additions to the drawbar which prevent it frem being interchangeable with the most common forms. It was a very serious matter for railroad companies in times past to carry thirty or forty different forms of drawbars as stock for the prompt repair of foreign cars, but it will be a much more serious condition of affairs if railroad companies are required to carry a multitude of forms of the new standard on account of slight difference in details. The individuality that has made Americans so fertile inventors of useful appliances is a most estimable national atribute; but tnere is a possibility of overdoing a good thing, and the man who is constantly trying to improve on an established standard is liable to prove a very expensive officer to a railroad company. Standards are never the result of entire unanimity of opinion. They are agreed upon by the sacrifice of individual preferences and prejudices, and it would be well for those connected with the charge of railroad rolling stock to display some forbearance toward the united self-abnegation that brought the standards into recognition.

The prevailing tendency to add to or take away from the connections which make a standard part useful is bad enough; but even a worse practice is that of varying a little in important dimensions of standard. A master car-builder imagines, often thoughtlessly, that he can strengthen or make more convenient a standard by altering slightly some part. Another man is careless with his pattern-maker, and patterns establishing the standard as it is to be used on an important system are so unskillfully made that the articles produced do not interchange with articles made from accurate patterns. A very important advantage accruing to railroad companies from the use of standard interchangeable parts is that they can be manufactured in large quantities by cheap processes, and sold as staple articles. The practice that the car departments of many roads follow of deviating from standard forms sufficiently to make them no longer interchangeable, make the companies concerned lose what ought to be the greatest gain brought about by the labors of the association in favor of uniformity. A Christie brake-shoe, a Master Car Builders' truss bearing or wedge, ought to be interchangeable, no matter where it may happen to be made, yet it is a melancholy fact that no manufacturer would accept an order from a railroad company for making any of these articles without first finding out the exact dimensions used by the road. In making the changes that render their standard parts no standard our New England friends have been very grievous sinners. There is so much ingenuity and inventive talent in New England that many of the men responsible for the care of cars find it impossible to restrain themselves from trying to improve on the established standards. The car builders in other parts of the country do not generally feel so free to put their individual ideas upon forms established by the association; but still there are all over the continent many deviations from the correct dimensions.

Between the inaccuracy of the carpenters who are sometimes employed as pattern makers, and the vagaries of would-be improvers, the standards of the Master Car Builders' Association are to-day in a very unsatisfactory condition. If a committee were appointed to investigate the existing condition of standards, and the extent of the deviations from established forms and sizes, we are persuaded that some very edifying information would be forthcoming. During the last few years the art of measuring has greatly developed, but there still lingers too much of the sentiment that leads to the ordering of United States standard threads to be slightly larger than the exact size. This loose, unmechanical sentiment is responsible for the inaccurate methods of doing work that have wasted much of the labor expended by the association in establishing standards. If master car builders without proper judgment are to be permitted to alter standards at their own sweet will, and the ordinary, and often extraordinary, pattern maker is to be depended on to measure the dimensions of standards from drawings, we fear that the standards of different roads will come to vary so greatly that the term will become an expression of deception. The evils that threaten railroad companies from the conflicting sizes reputed to be standard can only be arrested by the executive committee of the M. C. B. Association establishing master patterns and selling them to the railroad companies connected with the association. The first natural step in leading to action of this kind is the appointment of a committee to report on the existing condition of reputed standard parts.

Faultfinding with an American Compound Locomotive.

The Schenectady compound locomotive went into service after leaving the builders almost as quickly as the ordinary run of new engines, and there has been no difficulty experienced in keeping her working regularly against simple engines of the same capacity. This is an extraordinary record, considering that the engine was a radical change from established forms, and reflects the greatest credit upon those who perfected the novel details with so much success. Although the working of all the new mechanism has been all that could be desired, the details of design have not escaped criticism. A writer in the *Railroad Gazette* raised some captious questions about the intercepting value which brought out some silly editorial comment, and that again has elicited a curious letter from Mr. Von Borries, mechanical engineer of the Hanover Railroad and inventor of certain improvements for compound locomotives. Mr. Von Borries says of the Pitkin intercepting valve and Schenectady locomotive:

"This manner of working the intercepting valve is certainly not good for a quick and sure starting, because the first exhaust gives only a small pressure in the receiver, so that the pressure in the low-pressure valve chest will be much lessened by the opening of the valve and shutting off the live steam, causing an insufficient tractive force by the low-pressure piston and shaking motion of the engine and train. Our intercepting valves only open when, after two or three exhausts, the pressure in the receiver has become equal to the pressure of the live steam working the low-pressure piston, say 40 to 50 per cent. of the pressure in the high-pressure valve chest. Therefore, these valves only open after 1 to 1½ revolutions, when the whole train is in motion.

Experience has shown that it is not well to have too little pressure in the receiver after starting, because three or four revolutions are necessary to get the proper running pressure. Too much pressure on the low-pressure side when the valve opens is of no harm, because it is exhausted down to the proper working pressure by one or two exhausts.

The insufficient working of the intercepting valve on the Michigan Central compound, and the heavy and costly construction of this valve, also the defects experienced in the working of the gear of this engine (too high compression on high-pressure cylinder, and much resistance at high speeds) could have been avoided easily if the constructors had asked me or another member of our company for the proper dimensions and proportions of these parts, all these questions having been settled here long ago. Our compounds are said to run exceedingly easy at high speeds, better than others of the same power, this being caused by the greater travel of the valves, and consequently wider opening of the ports on each cylinder."

Those who are familiar with the construction and operation of the Pitkin intercepting valve will perceive that Mr. Von Borries has undertaken to criticise the working of a piece of mechanism he does not understand. The designing of intercepting valves has no doubt received a great deal of his attention, but he fails to comprehend the principle on which this one acts. If he had got the action of the valve through his head, he would have refrained from saying that the pressure in the low-pressure valve chest would be lessened by opening the intercepting valve and cutting off live steam. The valve is designed on the differential principle, and cannot open until the pressure from the exhaust steam is higher than the wire-drawn direct steam. When the latter condition exists, it is the proper time to open the valve so that live steam may be cut off, no matter what part of a revolution or how many revolutions the engine may have made.

It no doubt would have been highly gratifying to Mr. Von Borries had the designer of the first American compound locomotive gone to him for directions about how to perform his business, but we doubt if a better working engine would have been the result. We have seen something of the Von Borries and Worsdell compound locomotives, and their weak point appeared to be sluggishness in starting. When we consider this and compare the performance with that of the Schenectady compound, which is phenomenally smart in starting, we can realize how *mal apropos* is the expressed belief of Mr. Von Borries that the Schenectady "intercepting valve is certainly not good for quick and sure starting." The criticism of the intercepting valve which led to the correspondence we have been considering, was of the senseless character that one might expect to hear from an ignorant boy who was trying to pose as a mechanical expert. He supposed that the intercepting valve must be useless, or working unsatisfactorily, because it cut off live steam before the engine had made a full revolution. Men who believe that needing to be pinched off the center a few times during a trip is no material drawback to a locomotive, are free to argue that the arrangement for admitting steam to the low-pressure cylinder is a superfluity, but the practical men likely to have charge of locomotives will keep to the intercepting valve or some such device, even if its purpose is completed within the smallest fraction of the first revolution.

It seems to us that the confession of Mr. Von Borries that his intercepting valve does not close till his engines have made from one to one and a half revolutions indicates a serious defect of design. A revolution and a half would send three volumes of the high-pressure cylinder into the receiver, causing so much back pressure in the high pressure cylinder as to seriously retard the starting of the engine. "Too much pressure on the low-pressure side when the valve opens is of no harm, because it is exhausted down to the proper working pressure by one or two exhausts," says Mr. Von Borries. If engines so constructed had to start American trains, they would find it a very difficult matter to obtain the one or two exhausts that are necessary to give the engine full starting power.

The peculiarity about the Schenectady compound, which has contributed in no small measure to enhance her popularity, is the starting power being so nearly perfect, and no extra movement being necessary before this power can be applied to the driving wheels. While indicating the low-pressure cylinder of this engine when starting, the writer repeatedly held the pencil to the drum from the time the throttle was opened, and it was impossible to tell from the lines when the direct steam gave place to the exhaust steam from the other cylinder. During trials of the engine on the New York Central, a steam gauge was applied to the low-pressure steam chest, and it was found that when starting on a heavy pull, the pressure in the steam chest would vary less than 10 pounds when the exhaust from the high-pressure cylinder closed the intercepting valve. This is proof that the proportions of the intercepting valve and starting mechanism are about as nearly perfect as practical purposes require. The final test of all mechanism is utility, and there is every reason for believing that the details of the Schenectady compound have successfully passed the ordeal.

Means of Saving Coal.

Some of our British engineering contemporaries appear to derive a great deal of pleasure from periodically grinding out arid articles intended to imply that the American locomotive is a very costly machine to do work with. Recent labors in this line have been devoted to figuring up the quantity of coal used by the British and the American locomotives, and, of course, making the comparison odious to the latter. It would not be difficult to expose fallacies on which most of the claims for superior economy of English locomotives are based, but it is not worth while to declare the truth to those who are determined to deceive themselves. While we believe that American locomotives do the work they are called upon to perform, with as small consumption of fuel as any British engine could show while subjected to the same conditions, it may not be unprofitable to examine some of the drawbacks that our locomotives have to contend with in making a good coal record.

The common practice of rating locomotives to haul every car they can drag over the steepest grade on their division causes the majority of engines to perform the greater part of their work with the steam following the piston during the greater portion of the stroke. This uses up a great deal of steam in performing a given duty, and it makes such a heavy drain on the steam-generating capacity of the boiler that the fuel gases pass through the smoke box at a very high temperature, with the result that a comparatively small quantity of water is evaporated per pound of combustible used. This kind of service provides an excellent opportunity for the introduction of compound locomotives. It is now certain that compound locomotives can be built having all the tractive power in starting on a heavy, slow pull that the weight on driving wheels will admit of. An engine of this kind, working with the expansion lever in full gear, will make as good use of the steam as a simple

engine cutting off at half stroke. The direct saving of steam that would result from the change is obvious; there would also be considerable indirect saving from the improvement, as the boiler, being less forced, would generate a greater percentage of water for the coal used. American railroad freight trains provide a very promising field for compound locomotives.

But as the change to compounds must come very slowly, considerable improvement might be effected on the locomotives in use by careful attention to minor details that are within the control of railroad officers. A fruitful source of heat waste are the small nozzles that most of our locomotives continue to use, despite the numerous discussions that have taken place, in which the iniquity of the practice has been fully exposed and acknowledged. The persistency with which small nozzles maintain their hold on American locomotives is no doubt in a great measure due to the irregular quality of the coal supplied to most railroad companies. The average run of coal may be good at certain coaling stations and bad at others, through the varied quality turned out of different coal pits. Or the coal supplied to a division may be generally good, but through some cause at frequent intervals a few cars containing stuff that is nearly half slate or other impurity are unloaded at coaling stations.

To burn the small quantity of combustible in this mixture quickly enough for the requirements of steam making, a fierce blast is required, and this can only be obtained by the use of small nozzles. If the sharp blast cannot be maintained the fuel lies smoldering on the grates, little heat is created and time is lost for want of steam. "Bad coal" is not always accepted readily as an excuse for loss of time with important trains.

When an engineer goes through this experince once, and knows that bad coal will be supplied to him again in the course of time, it is natural that he should provide against it by calling for nozzles that will make his engine steam while burning the worst quality of coal supplied. The worst quality of the coal thus regulates the size of the nozzles, for they will be adapted to burn the inferior fuel successfully. The result of this is that when a good quality of coal is supplied, a considerable proportion of it is wasted through the action of the contracted nozzles, since they require the carrying of a thick fire to suit the intense draft created. This makes the engine not only wasteful of fuel, but it renders the keeping down of smoke impracticable, and leads to constant noise and loss of steam through the safety valves.

The proper remedy for this condition of affairs would be greater care in the selection of the fuel supplied. On most roads no attention whatever is bestowed upon having the fuel of uniform character, and there are few purchasing agents who know that there is any disadvantage in supplying fuel of varying quality. With very little extra labor coal of a uniform quality might be supplied, and there are very few improvements that would pay railroad companies better.

Master mechanics who fail to induce those controlling the fuel supply to provide coal of a uniform quality to all the stations of a division, might help their engines not a little by providing the means of softening the draft on the fire when good coal was used. A good smoke-box damper ought to be of valuable service in such cases. When time is lost on an important train on account of bad coal it is difficult for the head of the mechanical department to transfer the blame to where it rightly belongs, so he generally regulates the nozzle question to suit the requirements of the worst coal. The engine so adjusted is one-sided, unless provision is made by expanding nozzles or a smoke-box damper to adapt the draft to the requirements of the best fuel supplied. Neither of these devices has ever been popular, yet we believe that in many roads they might be advantageously employed.

Master Car Builders' Convention.

The indications which can always be noted in advance of the meetings of our railroad mechanical conventions promise large gatherings at both the coming conventions, and we believe that interesting and profitable meetings will be held by both associations, but there is nothing of a specially important character to be reported on for discussion. The first subject to be taken up by the Master Car Builders is the settling of the dimensions of the Fletcher oil box lid which was accepted as a standard last year. The next committee is that on metal for brake shoes, which will not report on the somewhat important subject under investigation. The subject of steam heating and ventilation of passenger cars is of general interest, and another year's experience has been obtained with the use of steam heating, which will give importance to the report. But it is likely to be little more than an undecided report of progress.

Steel plate and malleable iron in car construction brings forward a subject that ought to elicit a progressive report. It is doubtful if the builders and designers of cars have displayed the enterprise they might have manifested to advantage in securing material that would combine lightness with the requisite strength. The clear and decided statements that may be expected in this report may be the means of bringing about a movement which will result in materially lessening the dead weight now habitually hauled.

Two committees will report on subjects connected with passenger cars. It would be a convenience to the roads which are sending their passenger cars long distances away from home if the labors of the committee should result in the establishing of a code of rules for interchange of passenger cars. If the committee on expediency of a change in standard height of draw-bars in passenger equipment cars should succeed in making clear just what is the prevailing height of passenger drawbars, their labors will not be wasted. If they can do anything to bring about greater uniformity in the height of passenger drawbars they will increase the safety of travel by lessening the tendency of cars to telescope in case of collision. Many of our worst telescoping accidents have undoubtedly been made more disastrous through the upward movement imparted to the end of a car by a low coupling on its connecting car.

One subject which is not yet assigned for investigation, ought to receive the attention of both associations, and that is, the existing methods of selecting the place of meeting. In our correspondence columns Mr. J. D. McIlwain presents a somewhat ingenious plan for performing this difficult task. He would have three members from each association form a joint committee for making the decision. The letter ballot, by which the Master Mechanics' Association this year decided on what place the members preferred, worked very well, and we think that some modification of that plan would be found acceptable.

The Railway Master Mechanics' Convention.

The committees having on hand the business of reporting for the Master Mechanics' Association the subjects suitable for investigation and discussion have for the last two or three years acted as if they were afraid the Annual Convention would not have enough business to cover the three days devoted to the meeting. They have gradually increased the subjects to be reported upon till there are eleven reports to be read and presumably discussed at the convention, which will meet at Old Point Comfort on June 17. All the subjects are good, and some of them are of commanding interest and importance. It goes without saying that justice cannot be done to all the reports within the limited time. When a large programme is awaiting to be worked up by the members, the tendency is to rush the whole thing through with the feeling constantly present that expedition is better than deliberation.

The subject of Compound Locomotives alone, which is second on the list, ought at least to occupy the attention of the members during an entire session. Compound locomotives have come into extensive use abroad, and they have received a limited application on the railroads in this country, and there is great diversity of opinion about their real value. It is highly important for our railroad interests that the truth about compound locomotives should be impressed upon the members of the Association, and nothing can do so in a more effectual way than full interchange of experience and opinion.

"Testing Laboratories, Chemical and Mechanical," is another comparatively fresh subject, although it was up for discussion at the convention held in Chicago in 1874. At that time men were just beginning to find that the means of testing material with scientific accuracy was highly desirable, but they had rather crude ideas as to how railroad companies should use laboratories for testing purposes. At that time the prevailing idea on this subject was that a laboratory might be successfully established as an auxiliary of the Association. The proposal to carry out such a scheme was happily rejected, and railroad companies began to find its proper place and vocation for the laboratory. If the Association succeeds in informing its members fully on the work done by railroad laboratories, and the advantages resulting from their use, a valuable educative work will be accomplished.

For the first time in the history of this Association, a committee will be called upon to report on a subject that has formerly been left exclusively to the Master Car-Builders' Association. For some reason that did not come out clearly at the last Convention a committee was appointed to report on "The Present Status of the Automatic Car Coupler Question," and whether the Association can endorse, from a mechanical standpoint, the action of the Master Car Builders' Association in recommending the vertical plane type as a standard. We are afraid that small glory will accrue to the Association out of this investigation.

Consolidation of the Mechanical Associations.

Some of our contemporaries are exciting themselves very seriously about the present condition of the Master Car Builders' and the Master Mechanics' Associations, and the intimation is plainly imparted that unless some momentous and radical change takes place soon the organizations are doomed to destruction. We believe that predictions of this character have been made before and the associations survived the promises of coming woe without fear or trembling or any loss of energy, and it is just possible that history may repeat itself in this particular case again.

There has been a good deal of talk about the advantages that would arise from a consolidation of the two associations, but we are not particularly carried away with the benefits that would be conferred upon the members or upon railroad interests by the change. If, however, the majority of the members of the Master Car-Builders' Association, which is the most interested in remaining separated, vote for consolidation, we shall willingly acquiesce in the decision. This is reported to be a free country, and it is not a bad plan to permit the members of law-abiding associations to manage their own business according to the views of the majority as to the eternal fitness of things. We believe that it would be better for the members of both associations and for the railroad interests they represent to hold the conventions at the same place and with a smaller interval between them. If the two associations would agree to meet at the same time and place and hold alternate sessions, it might work well, and certainly would improve the attendance. As a preliminary to such a movement we think the Master Car Builders' Association ought to appoint at the next convention a committee to confer with such a committee from the Master Mechanics' as to the practicability of bringing the two organizations into closer relations. If nothing else come of the movement, it ought certainly to result in an arrangement for having the two conventions meet at the same place.

The American Society of Mechanical Engineers held a very interesting meeting at Cincinnati beginning May 13. There was a large attendance, many of the most distinguished engineers on this continent being present. An address of welcome was delivered by President Ingalls, of the Cleveland, Cincinnati, Chicago & St. Louis Railway. The meeting was ably presided over by President Oberlin Smith.

The subjects discussed were not of much interest to railroad men, with the exception of a paper on The Efficiency of Locomotives, by Mr. W. F. Dixon, an abstract of which is published in another page. We regret that want of room prevents us from publishing this paper in full, as it gives a very careful consideration of the locomotive as a prime mover. There is a tendency among the classes of engineers who do not come in intimate relation with railroad operating to regard the locomotive as a very wasteful engine, and the purpose of Mr. Dickson's paper evidently was to put the truth regarding locomotives before the profession. The paper is of a highly practical character, but goes into theoretical investigations also, and expresses the views held about the locomotive by the most eminent railroad engineers of this and other countries. We commend a careful study of the paper to those interested in locomotives.

At the annual conventions of the Railway Master Mechanics' Association, it has been customary to receive an address of welcome from the Mayor or some other leading dignitary of the place where the meeting is held. This year the convention will be held at a place where there is no town, so the Executive Committee considered that it would be a good plan to invite President Ingalls, of the Chesapeake & Ohio, to deliver the opening address. Mr. Ingalls is one of the most able and prominent railroad presidents in the country, and he is the head of a railroad company that is doing a great work for the district in which the convention will be held. All those interested in the success of the association will be pleased to learn that President Ingalls has consented to address the convention, and that he expects to spend a day at the meeting.

RAILROAD ENGINEERS' FIELD BOOK AND EXPLORERS' GUIDE. Especially adapted to the use of railroad engineers on location and construction, and to the needs of the explorer in making exploratory surveys. By H. C. Godwin. New York: John Wiley & Sons. Price $2.50.

This is a convenient engineer's pocket book, and contains in compact form the information and references most liable to be required by the class for whom it has been written. The book has been written with a view of avoiding intricacies of mathematics wherever possible, and a very simple as well as convenient treatise is the result. The book ought to be in the pocket of every railroad engineer.

Our highly interesting contemporary, the *American Machinist*, has been increased in size four pages, and the price raised from $2.50 to $3 a year. The old attractive form is retained, and readers are certain to get full value for the increase of subscription. The *American Machinist* has been a remarkable success throughout its whole history, and it well maintains its merit and reputation under the editorial management of Mr. F. F. Hemenway, the chief editor.

Those who expect to attend the conventions of Master Car Builders and Master Mechanics at Old Point Comfort will be pleased to learn that the proprietors of the *Northwestern Railroader* have arranged to issue daily editions of their paper during the continuance of the meetings. This has been done at the last four conventions, and has each year been highly appreciated by the people in attendance.

Personal.

Mr. C. H. McKibben, General Purchasing Agent of the Union Pacific, has resigned.

Mr. G. W. Cushing has resigned the position of superintendent of motive power of the Union Pacific.

Mr. Robert Preston has been appointed locomotive superintendent of the western division of the Canadian Pacific.

The Governor of Minnesota has appointed Mr. J. L. Greatsinger, of the Duluth & Iron Range, a commissioner to select the site for a lighthouse.

Mr. Walter Webb, vice-president of the New York Central, is suffering from affection of the sight organs which threatens to cause total blindness.

Mr. H. A. Whitney, mechanical superintendent of the Intercolonial Railway, has been laid up for over six weeks through injuries sustained in an accident.

Mr. J. Kerr has been appointed master mechanic of the Mexican National road, succeeding Mr. W. I. McCammon. His headquarters will be at the City of Mexico.

Mr. Bernard Fitzpatrick, general foreman of the shops at Ft. Wayne, Ind., has been promoted to Master Mechanic of the Pennsylvania Company's shops on the Cleveland division.

It is said that Mr. Stephen L. Bean, division master mechanic of the Northern Pacific at Fargo, N. D., will succeed Mr. John Player as superintendent of motive power of the Wisconsin Central.

Mr. W. H. Apple has been appointed master mechanic of the Ashland Coal and Iron Company, in place of Mr. E. M. Roberts, resigned. Mr. Apple was formerly general foreman under Mr. Roberts at Ashland.

Mr. Thomas H. Stryker has been elected president of the Rome Locomotive Works, Rome, N. Y. Mr. Stryker has been for some time secretary of the company and is the son of a gentleman who was well known among early engineers.

The many friends of Mr. John A. Hill, editor of the *Locomotive Engineer*, will be sorry to hear that he has lately lost, after a few days' illness, a very bright and attractive girl three years old, his only remaining child. He lost another one about a year ago.

Mr. Geo. L. Fowler, an occasional contributor to our columns, has opened a mechanical engineers office at 171 Broadway, New York. Mr. Fowler has had considerable valuable railroad experience and will make a specialty of matters connected with railroad rolling stock.

Mr. A. C. Hincley, formerly inspector of locomotives and machinery for the Union Pacific, has been appointed assistant superintendent of motive power of the same company, with headquarters at Salt Lake City, and will have charge of the Wyoming, Utah and Idaho divisions.

Mr. John M. Sanborn, master mechanic of the Lake Shore & Michigan Southern Railway, at Norwalk, O., died suddenly on May 12. He was for some time master mechanic of the Cincinnati, Sandusky & Cleveland Railroad, and was a member of the Railway Master Mechanics' Association.

Mr. Barney Fitzhugh, who has been promoted from the position of general foreman of the shops of the Pennsylvania company at Fort Wayne, Ind., to that of master mechanic at Cleveland, O., has been presented with a handsome gold watch studded with diamonds, by the 900 employés of the shops at Fort Wayne.

Mr. G. S. Allen, master mechanic at Tamaqua, has been appointed master mechanic of the Williamsport division. This division is 124 miles long, and has six repair shops, located at different points along the division, the largest being at Tamaqua. Mr. Allen now has charge of all shops, shop hands, engineers, firemen, and 155 locomotives.

Mr. John W. Cloud, secretary of the Master Car Builders Association, has been appointed Western agent of the Westinghouse Air Brake Company, and the announcement has been made that he intends resigning the position of secretary at the coming convention. He has performed the difficult duties connected with the office very satisfactorily.

The citizens of Newark have erected a finely-executed bronze statue of Seth Boyden, the eminent inventor and mechanic. Boyden built some locomotives in the early days of railroading, that were famous in their time, but his chief claims to distinction were in connection leather with manufacture. He discovered the method of making malleable iron castings.

Mr. W. T. Small, of the Northern Pacific, has not been enjoying the smiles of fortune to a great extent this year. In the early part of the winter he was prostrated with an attack of pneumonia, which laid him up for several months He is now confined to the house with a broken ankle sustained through an accident caused by an axle breaking under a buggy in which he was riding.

Chauncey M. Depew, who complacently stood it while his picture did service as that of a doctor of divinity, a champion athlete and circus manager, is beginning to feel that the line ought to be drawn. Last week he discovered in a Joliet, Ill., newspaper what he regards as the best portrait of him yet published, and underneath it is the name of an absconding alderman of that town.

Mr. Harvey Middleton, who has left the Santa Fe system, to succeed Mr. Cushing on the Northern Pacific, is one of the best known and most popular of our railroad mechanical officers. He was for some years assistant to Mr. Reuben Wells on the Louisville & Nashville, and became the head of the department when his chief left. From there he went to Santa Fe two years ago.

Among new members that have lately joined the Railway Master Mechanics' Association are Mr. J. O. Pattee, Great Northern; Mr. G. B. Hazlehurst, of the Baltimore & Ohio; Mr. A. L. Humphrey, Colorado Midland; Mr. Peter H. Murphy, St. Louis, Alton & Terre Haute; Mr. J. H. Agnew, South Carolina; Mr. Edward May, Intercolonial; Mr. R. Atkinson, Canadian Pacific; and Messrs. H. Monkhouse, Wm. Gessler and A. L. Studer, Chicago, Rock Island & Pacific. The increase of members since last convention has been very great.

Mr. George B. Harris, vice-president and general manager of the Chicago, Burlington & Northern, has been elected second vice-president of the Chicago, Burlington & Quincy, to succeed Mr. Henry B. Stone, who resigned to become president of the Chicago and Central Telephone companies. Mr. Harris will also act as general manager until a successor is appointed to Mr. E. P. Ripley, resigned. Mr. Harris was formerly assistant general manager of the Atchison, Topeka & Santa Fe. He has been connected with the Chicago, Burlington & Northern since October, 1885, first as assistant to the president, but a month later he was appointed general manager.

Mr. F. C. Robinson, who has lately been appointed master mechanic of the Chicago & West Michigan, at Mushkegon, Mich., came from the Atlantic & Danville, which he had to leave on account of ill health. Mr. Robinson was raised on the Wabash, where he passed through the shops and finally became a locomotive engineer. From there he went to the Panama Railroad, where his principal experience was in passing through an attack of yellow fever. He then returned to the Wabash, where he was round house foreman, and by degrees through various changes reached the position of master mechanic. He is a reading man and keeps well posted on the literature relating to his business, thereby gaining much of the knowledge that has recommended him for advancement.

Mr. William Swanston, Master Mechanic of the Chicago, St. Louis & Pittsburgh, was one of six railroad men who met at Dayton, O., June 10, 1868, for the purpose of takin action to organize an association of railway master mechanics. Mr. Swanston is the only one in the party who continues in railroad service, and there is only one of the others alive, Mr. Reuben Wells, superintendent of the Rogers Locomotive Works. The meeting was adjourned to meet at Cleveland two weeks later, when 20 master mechanics were present, and the organization was then formed. Of the 20 men who then became charter members, none remain in railway service except Mr. Swanston, and only six are alive, viz.: Reuben Wells, William Swanston, Albert Congdon, Jacob Losey, N. E. Chapman, S. M. Cummings and Isaac Dripps.

One of the most delightful books we have ever read is the autobiography of James Nasmyth, the inventor of the well-known steam hammer and one of Great Britian's most eminent mechanical engineers. This hero of peaceful industry has just passed away at the ripe age of 82. He was a Scotchman by birth and was the son of an eminent artist, whose genius he inherited and applied it to constructive designs at a time when the harmonizing influence of the artist was badly needed. He received the best engineering instruction that was to be had in the first quarter of this century, and in 1834, at the age of 26 years, began work for himself in a shop near Manchester. The steam hammer was designed for the purpose of forging the paddle shaft of a steamer. He was the inventor of a variety of other useful machines. Nasmyth prospered so well in business that in 1858 he retired and devoted the remainder of his life to scientific pursuits. He is the author of several well-known books.

Mr. James Mackenzie, general foreman of the Western division of the Hannibal & St. Joe road, died in Chicago on the 18th instant, aged 66 years, while on the way to visit his son, Mr. John Mackenzie, superintendent of motive power of the New York, Chicago & St. Louis road. The cause of his death was neuralgia of the stomach, from which he had been a sufferer for some time. Mr. Mackenzie was a thorough mechanic and draughtsman, and has had charge of some of the most important private machine manufacturing shops in the West. He was for several years master mechanic of the Kaw Valley division of the Kansas Pacific Railroad, but in 1882, his health failing, he resigned that position, and after resting and traveling for several months, he accepted the position that he held at the time of his death. He was an upright and honest citizen, respected in the community in which he lived, kind and generous to the men under him, and always had their confidence. His remains were taken to Adrian, Mich., for interment in the family burial place.—*Railway Review.*

Mr. John Player, of the Wisconsin Central, has been appointed superintendent of the Atchison, Topeka & Santa Fe system, to take the place of Mr. Middleton, resigned. Mr. Player is as able a mechanical engineer as there is in the railroad service of this country, and he has besides unusually good executive ability, and few officers have been so successful in the handling of men. He has reached his present position through sheer merit and energy. Mr. Player received an excellent mechanical training in the Royal Arsenal at Woolwich, England, and came to this country sixteen years ago and went to work as a machinist in the Central Iowa shops. Because he was the right man he rose successively to be general foreman and then master mechanic. Three years ago he was offered the position of superintendent of motive power of the Wisconsin Central, which he accepted. There he quickly restored order from chaos, and changed wastefulness to strict economy with such conspicuous effects in the operating expenses that his call to a higher position was assured.

Nearly all railroad men are acquainted with Mr. F. W. Coolbaugh, agent for the Boies car wheel and other railroad specialties, and himself an old railroad man of long experience. Frank, as his intimate friends delight to call him, is fond of a quiet joke, but he declares these days that practical jokes no not count as fun. As everybody knows Frank was raised in the Fifth Ward, in New York, and consequently his acquaintance with rural matters is entirely theoretical, but he loves to dwell amidst the green trees and verdant lawns of the country, and has lately built for himself a fine house in East Orange, N. J. He displayed an ardent desire to beautify the grounds attached with flowers and shrubs and invoked the advice of friends as to what was best to plant. To an acquaintance he confided his desire to see some climbing rose bushes about the place. His acquaintance volunteered to supply some fine rose bushes of a rare kind, and a few days afterward Frank called for them and planted out the thorny stems with the greatest care, and devoted a great part of his spare time to watering and tending them. When the fancy rose bushes opened their leaves and budded out with the advance of spring, they gave forth the promise of producing an excellent crop of raspberries.

An extraordinary business man is Mr. Charles A. Moore, of the well-known firm of Manning, Maxwell & Moore. The firm does an exceeedingly large business in railroad and other supplies, and Mr. Moore attends to and rushes through an immense volume of office work, besides making comet-like flights to points all over the continent where business requires his presence. His routine business duties are of a kind that require a mental giant as a carrier, yet they appear to be as nothing compared to the kind of pastimes Mr. Moore indulges in. He is the leading spirit in certain clubs, and as a relaxation for his leisure hours does more hard work in connection with these than the paid secretaries perform. He takes an active interest in the political affairs of his district, and always finds time to attend the meetings and to infuse life into the deliberations of the leaders or to make an occasional trip to Washington in the interests of his friends. He was chosen as a member of the New York World's Fair Committee, and was the only member who attended every meeting of the committee, and he frets that New York lost the fair since it prevents him from devoting a slice of his time to its affairs. With all that he is ever ready to volunteer his services to accompany any railroad man interested in machinery to the Pond Machine Works, or to some of the other manufacturing establishments belonging to his company.

The letter in another column from Mr. W. C. Hayes on "Notable Locomotive Performance," is of much greater significance than what appears on its face. The Minneapolis & St. Louis Railway Company is struggling against adversity resulting from unjust legislation, and the letter, which is from an engineer, indicates that the employés who have powerful influence in restraining expenses of operating are interesting themselves to keep down the running expenses as low as care and skill can effect. Considering the physical character of the road and the trains hauled, the locomotive performance given is highly satisfactory. But more satisfactory still is the fact that the employés, whose prosperity is linked with the prosperity of the company, realize their duties as men and perform them faithfully.

The *Frog* has made an aspiring jump, and they now call it *The Western Railway*, published in Denver twice a month, Cy. Warman, editor and manager. Other editors will sigh many times over their work before they produce a paper equal to *The Western Railway*. We are at a loss which most to admire, the bright, newsy features, or the sparkling wit and stirring fun that emanate from every page.

To Strengthen Ends of Passenger Cars.

There are forcible illustrations of the need for improvement in the end construction of passenger train cars to reduce the liability of telescoping in collisions. Take the case of the rear collision on the New York Central Railroad last September, in which the last car (an official car) was very slightly damaged, although struck by the locomotive of the train following, while the next two cars (a private car and a sleeping car) were badly damaged by telescoping, and lives were lost and persons maimed. About that time much comment was made by the press on the construction of the official car that received the brunt of the blow and was only slightly damaged. It is quite possible that the cars that were so badly damaged were just as well constructed, but not as well maintained.

The vestibule has done much towards reducing the probability of telescoping to a minimum, but unfortunately the number of vestibule cars is very small, being confined to a few limited trains, and in many of these may be found near the front end cars without vestibules. However, there are several theories that might be advanced with considerable credence, as the cause and prevention of telescoping casualties.

The principal cause of telescoping might be attributed to the variation in height of platforms. This is caused, first, from the various modes of construction on different roads, the rise of platform timbers varying in height above the bottom line of end sill from four to seven inches; second, the variation in height of car bodies on trucks; third, and most prolific cause of trouble is the want of attention in keeping the platforms up in uniform line with the floor timbers of car. It will not require very close observation to notice this defect in the maintenance of passenger cars. Some roads are very particular to keep their platforms up, while others give it little or no attention, and cars may be seen coming out of shops freshly repaired and painted, but very much "down at the heel," as regards platforms. Master car-builders that permit this sort of thing certainly have a weakness as to proper maintenance. To illustrate, cars coupled together like Fig. 1 may be seen daily, more especially on roads that haul trains made up with different companies' cars. What the result would most likely be in a collision is shown in Fig. 2. Is any one ready to assert that the cause of the casualty above referred to was not just such conditions as here shown in the two cars telescoped, and that what prevented the rear car in train from worse damage than it received was not because the plat-

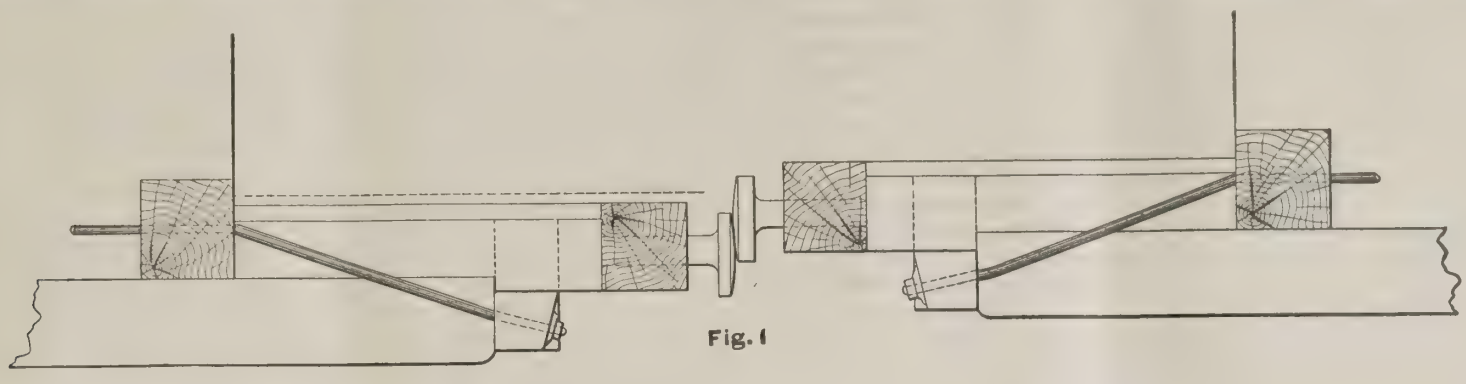


Fig. 1

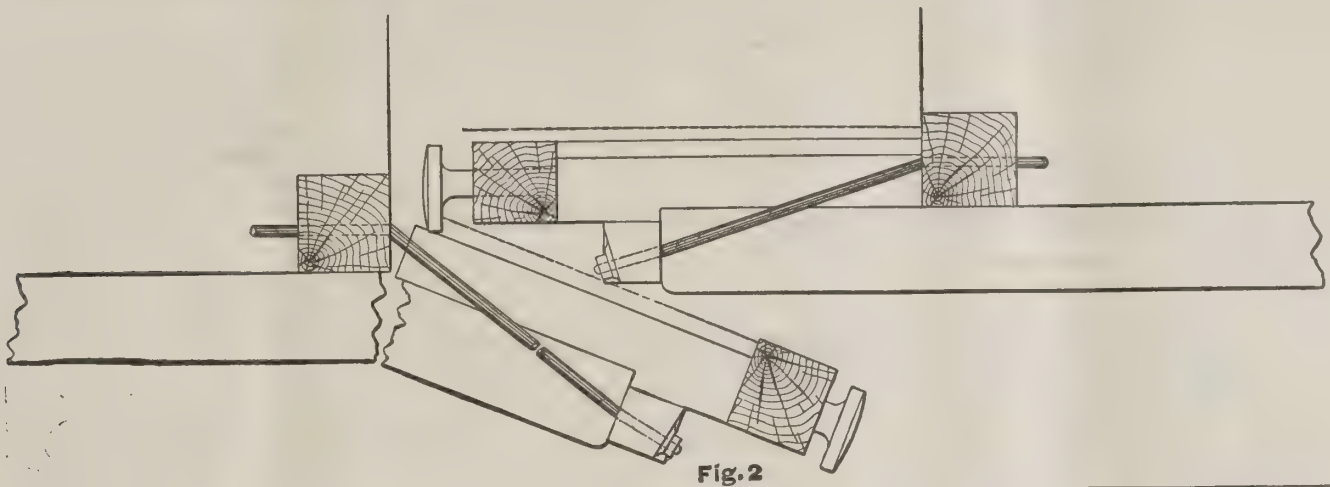


Fig. 2

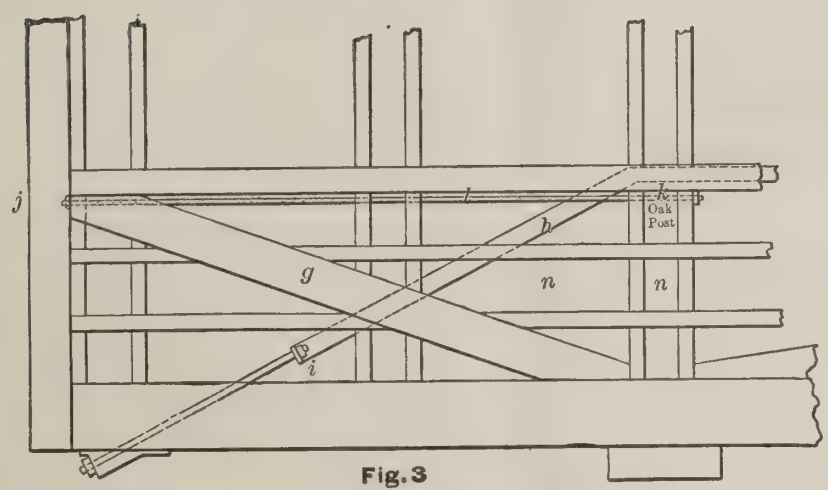


Fig. 3

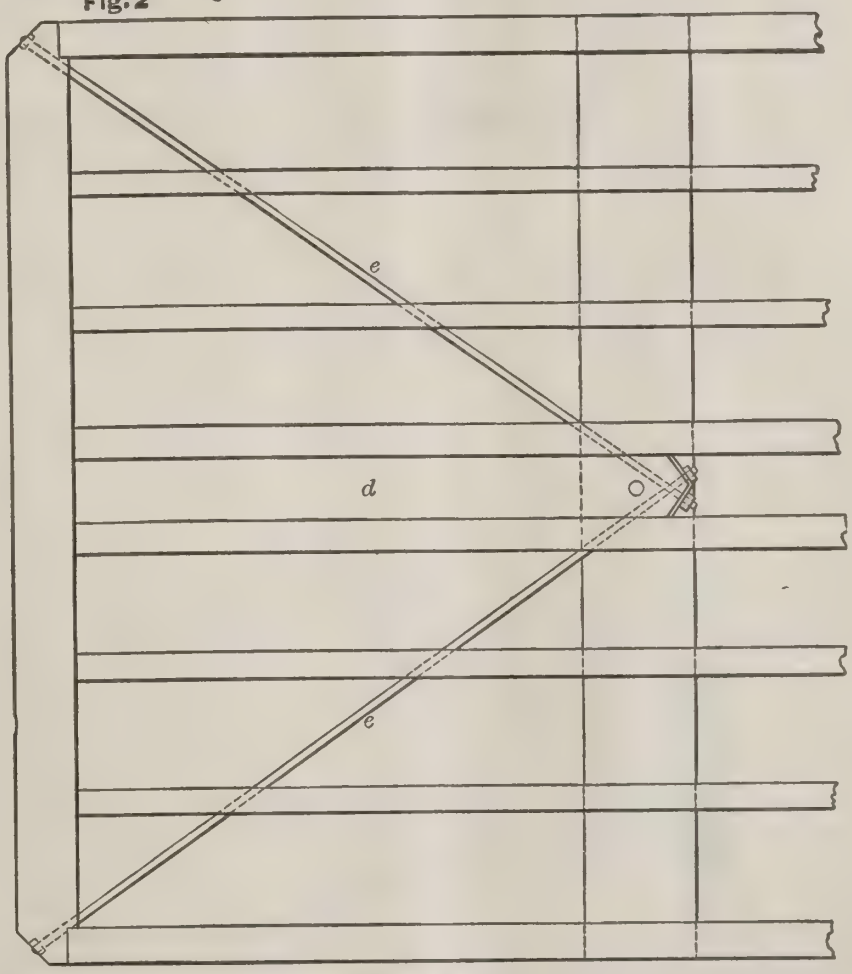


Fig. 5

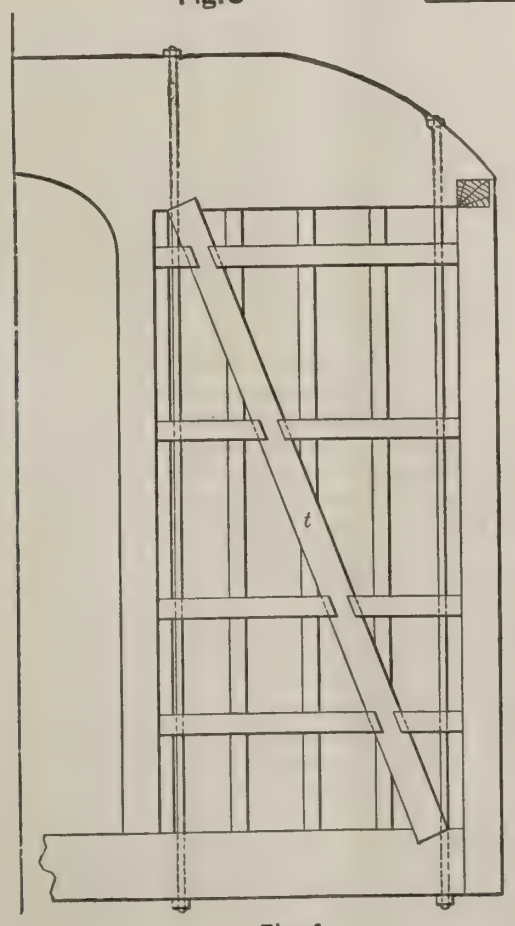


Fig. 4

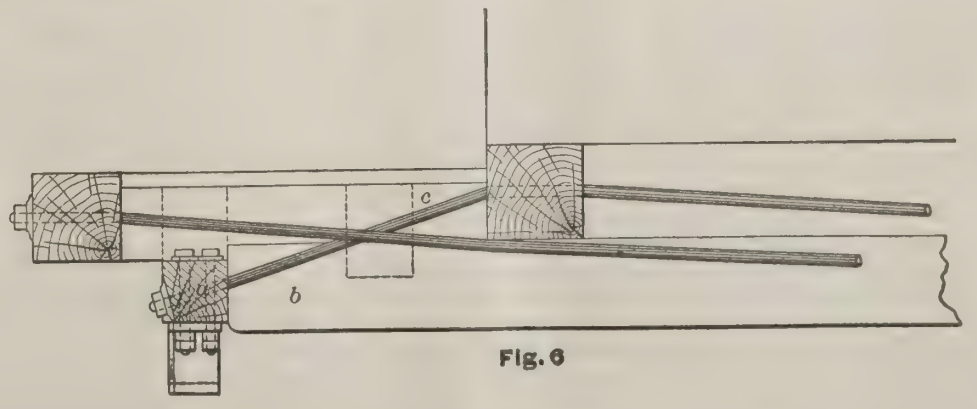


Fig. 6

form timbers were the proper height and well trussed, and the end sills of sufficient thickness and well supported at centre with braces and eight floor timbers of proportionate size and strength? The plan shown in Fig. 5 may be considered a little too advanced by some, but it is worthy of some attention.

From observation covering a large number of wrecks, and under as many different circumstances, I am convinced that the weak points developed are principally the platforms, end sills, and side and end bracing. First, the platform timbers, either Miller or Janney, should be of no less thickness than the floor sills to which they should be bolted. The projection above the bottom line of end sill should be not less than 5 inches; the truss beam *a* in Figs. 6 and 7 should extend over four of the platform timbers *b*, with four platform truss rods *c*, instead of two, as is usual. Next, the end sill should be trussed horizontally (see Fig. 5), the fulcrum of truss being supported by filling piece *d* in between the centre floor timbers or sills. This kind of trussing is not customary; the truss rods *e* run diagonally from a point near centre plate to each corner of car. The object of this is to give greater strength at the point of resistance, and to keep the car square laterally near the ends. As most of the causalties occur on curves, the tendency is to strain the body out of square or line when struck.

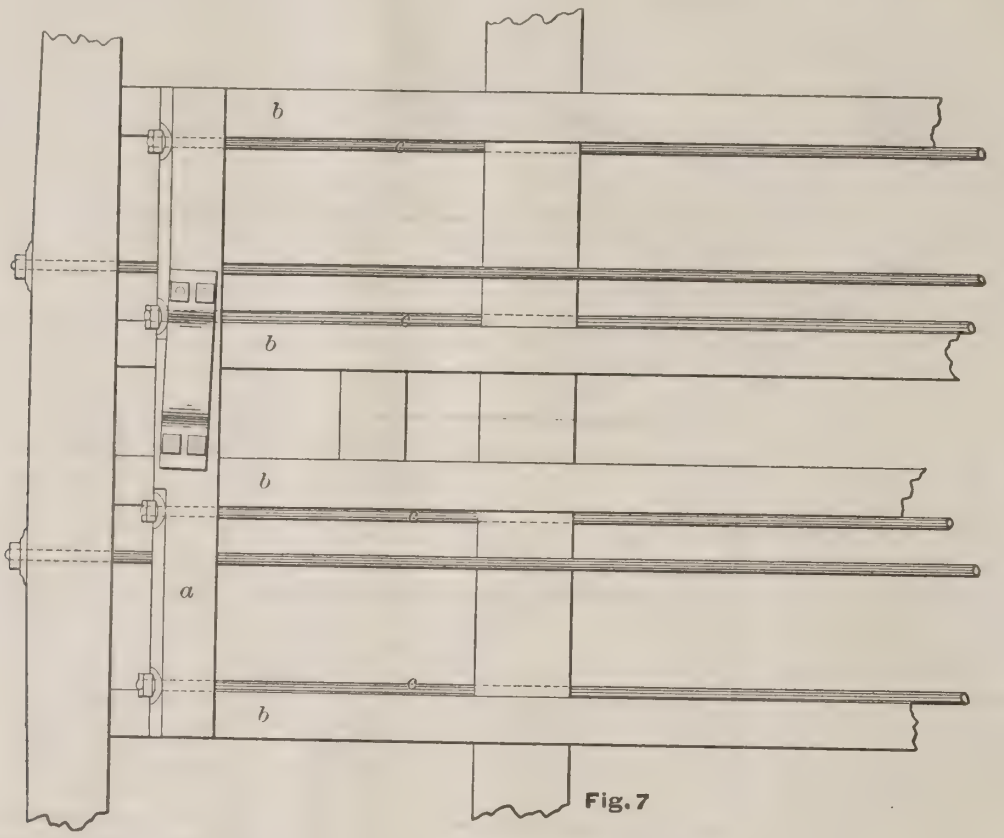


Fig. 7

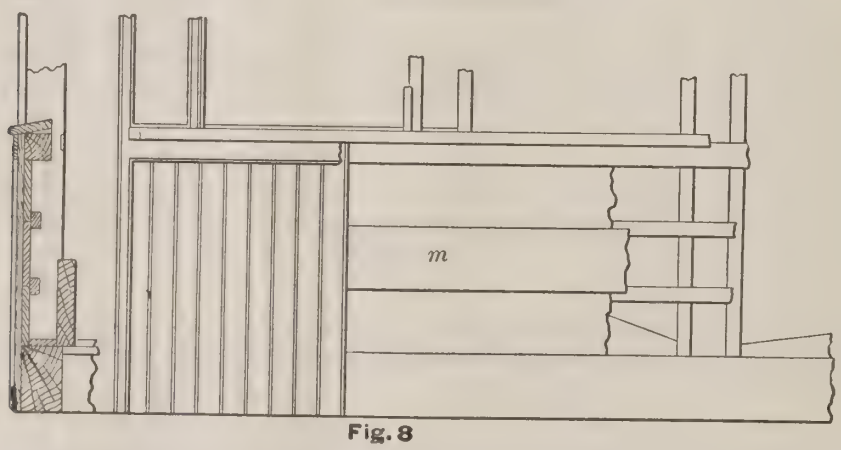


Fig. 8

As the modern car is built without end windows, it is much easier to construct the end to meet the resistance than where the windows were used. End post can be made heavier, braces *f* (Fig. 4) can be used to reach from lower outside corner to plate at door head, better assisting to hold up center of end sill. [Do you know, Mr. Editor, that many years ago there were some M. C. Bs. that believed (and worked by that belief) it was the proper thing to brace the ends of a car from centre outwards? Fact! Some of them still live, but have retired.]

At bottom ends of post and braces the flooring should fit snug, also the tenons should be in proportion to the size of post, not as is often seen, an inch tenon for a four-inch post. The end sheeting or panels should extend from bottom of end sill to plate without a break at belt rail, which is common in car construction, and which only adds cost and weakness without strength or beauty. The methods of side-bracing passenger cars are many. The best combination to stiffen the sides and add strength to resist end concussions is shown in Fig. 3. A mechanic with half an eye can see in every passenger train more or less cars with ends drooping. If the "mask" were pulled off from such cars, and the skeleton exposed, the cause of such depression would be plain. The wooden brace *g* is applied in the usual way; the longitudinal truss bar *h* differs from the common method: the round bar is not welded to the flat bar, but the end of the flat bar is made in the form of a clip or pocket holding the nut for rod (see *i*). Too often this is considered enough to hold up the ends of car, but time and use prove otherwise, as often the corner post bulges out at *j* and the truss post *k* gives way in the opposite direction. To prevent this a tie rod *l* is used, which is very effectual in preventing this spreading.

The belt rail is $2\frac{1}{2} \times 4$ inches, the face of post is flush with belt rail on top, and cut back $\frac{3}{4}$ inch below, between belt rail and sill; this $\frac{3}{4}$ inch space is for oak siding, *m*, which is fitted in close between belt rail and sill and faced off flush with face of sill and belt rail. This siding is glued and nailed with wire nails to post and rails, and angle blocks glued on inside. The outside sheathing or panels are then leaded and nailed to this face. This longitudinal hardwood siding applied in this manner certainly adds great strength to the car frame to resist concussion. It also gives stiffness to support the ends and centre of car body.

The practice is becoming quite common with some carbuilders to fill in the space between the post and rails *n*, and the belt rails and sills with blocks $\frac{7}{8}$ inch thick, which are fitted in close, the post being rabetted to receive these blocks which are glued in. Superficially this looks well and makes a nice face to panel on; but practically, as compared to the other plan shown in Fig. 8, it looks very much like glueing a number of blocks together endways, and expecting it to be as strong as a single piece of the same length.

Going back to the original point, the method described and illustrated is the result of practical experience, not theory altogether, and has proven the best for the purposes claimed, *i. e.*, to best strengthen that part of the car body subject to the strain made by the never-ending railway accidents. PROGRESSIONIST.

Car Interchange Decisions.

The Arbitration Committee of the Master Car-Builders Association have lately made an important decision on a question relating to air-brake equipment on freight cars that there has been some difference of opinion about. A freight car belonging to the Oregon Railway & Navigation Company was destroyed on the Northern Pacific, and the latter company elected to settle for the car destroyed. A bill was rendered for the car, the proper allowance being made for depreciation due to age, and then $50 was added for the value of the air-brake equipment. The Northern Pacific raised the question if it was not proper to include the value of th air-brake apparatus before the deduction for depreciation was calculated and appealed to the Arbitration Committee for a decision. This committee decided that the bill as rendered was correct. The text of the decision informed the appealing company, that according to Rule 22, $50 had to be paid for the air brake, but that the road destroying the car had the privilege of returning the air-brake apparatus complete and in good condition. This decision will end all the disputes that arise on this question.

The Missouri, Kansas & Texas substituted a different form of drawbar for a Potter drawbar belonging to a Chicago, Burlington & Quincy, and a claim was made against the former company for the value of the drawbar and of the followers and spring, which were also changed. The Arbitration Committee sustained the claim.

The Cleveland, Cincinnati, Chicago and St. Louis replaced wheels under a Nelson Morris Co car and charged the owners ten per cent. above the bill that would be rendered to a railroad company. The Nelson Morris Co. appealed against the extra charge to the Arbitration Committee and it was decided that, under the Rules of Interchange, the extra charge was legal.

The Kansas City, Fort Scott & Memphis replaced drawbars on some Missouri, Kansas & Texas cars, and in doing the work did not adhere to the rule requiring repairs to conform to the original construction. The company owning the cars sent in a claim against the Kansas City, Fort Scott & Memphis for cost of changing the drawbars, which was disputed and appealed to the Arbitration Committee for decision. The result was that the Kansas City, Fort Scott & Memphis were held liable for the bill.

The Louisville, New Orleans & Texas changed the axles of a Chicago, Burlington & Quincy car when they were putting in new wheels, although the old axles were not defective. They made a charge for new brasses because the old ones would not fit the new axles. The owners of the car refused to pay for the new brasses, alleging that the change which called for new brasses was not necessary. On the case being appealed to the Arbitration Committee, the position taken by the Chicago, Burlington & Quincy was sustained.

A car belonging to the Pittsburgh & Lake Erie was damaged while on the New York, Lake Erie & Western, and the latter company repaired the car, but used ceiling $3\frac{1}{2}$ inches wide on the roof instead the width of $2\frac{1}{2}$ inches originally on the car. The car was passed by the joint inspector and accepted by the company, but they afterward presented a bill against the company effecting the repairs, on the ground that they were not done according to the requirements of the Interchange Rules. The Arbitration Committee held that there was no ground for a charge.

The Ogdensburgh & Lake Champlain delivered to the Rome, Watertown & Ogdensburgh a foreign car which had a journal smaller than the prescribed limit. The joint inspector for both roads had no O. & L. C. defect cards on hand, and advised the R., W. & O. company that he would obtain a card and forward it. Meanwhile the car was offered to the owner and refused because it had no defect card, and the R., W. & O. held the car and made the necessary repairs. The defect car was forwarded by the inspector, and under it the claim was made on the O. & L. C. for the expense of the repairs. That company refused to pay, on the ground that the card, having no tack holes on it, Rules 4, 5 and 6 had not been complied with. On appealing the case to the Arbitration Committee, that body decided that the owners were responsible for the repairs, as the axle had gone below the safe limit by ordinary wear of service.

A somewhat difficult dispute arose between the Chicago & Northwestern and the Chicago, Burlington & Quincy Railroads, which was referred to the Arbitration Committee for settlement. The Chicago & Northwestern delivered to the Chicago, Burlington & Quincy a car to be placed in the lumber district to be loaded for a point on the owner's road. When the car reached the owner's road there were two brasses missing, and two oil boxes were worn through the saddle. The owners of the car claimed that the Chicago, Burlington & Quincy were responsible for the repairs necessary on the car, and the latter company held that the brasses were stolen in a private track and that they were not liable. The Arbitration Committee decided that as the Chicago, Burlington & Quincy took the car out of the private siding, they were responsible for its inspection, and that therefore they were entitled to pay the expense of putting the car in good order.

A recent press dispatch from Pittsburgh says: The construction of electric street railways is to be undertaken on an extensive scale when George M. Pullman, the millionaire car builder, and George Westinghouse, Jr., complete the formation of the company in which they are to be associated. The main office of this company will be either in this city, where the Westinghouse Electric Company has its plant, or in Chicago, near which city the Pullman Palace Car Company has its works. Mr. Pullman has made flying trips hither to see Mr. Westinghouse. The latter went to Chicago a few days ago to settle the details of the consolidation. The two went to New York city, and, it is said, interested men with capital in their joint scheme. The operations of the company are intended to be of greater magnitude than any railway builders have yet attempted.

Communications.

Slipping of Driving Wheels.

Editor National Car and Locomotive Builder:

I have read considerable in your paper of late about the cause of locomotive drivers slipping when an engine is running down a grade without using steam. The explanations are, no doubt, highly scientific and all that; but yet they leave me in the position of a doubting Thomas who wishes to exercise the privilege of asking questions and ventilating new doubts. To me the discussion is very much like one that arose among scientists some years ago about, why it was that when a live fish was put in a globe filled with water it did not add any weight to the vessel. Very learned arguments were advanced to explain the phenomenon, and different sides were taken by the savants interested, and they got quarrelling about what was the true cause Blood might have been shed in the dispute, had it not been that some man with horse sense made an experiment and discovered that the fish added exactly its own weight to the vessel.

Our engineering fraternity are not yet quarrelling over the slip of drivers, but they may be so soon if the question remains open, and I would move that it be settled by finding out if there is such a thing as the slip spoken of, for I am seriously in doubt about its existence. I rode upon locomotives for about fifteen years, and upon all kinds of them. Some of them were good engines, many others were of the scrap heap variety. They varied as to sizes of drivers and as to the number that were coupled together. There were well balanced and badly balanced engines among them. Some appeared to have too much counterbalance weight and some of them too little, while others seemed to have just enough. I had heard that some engines were in the habit of slipping while running down hill, and I had been led to believe that some of the machines that I ran indulged in the practice at odd times. Somehow they never ventured on any tricks of that kind when I was at the throttle, and I came to the conclusion that slipping of drivers going down hill had some connection with the ghosts I used to hear about when I was a boy. Nothing was more certain than that ghosts frequented certain places, but they could only be seen by a favored few. As my knowledge of this wicked world matured I came to doubt the existence of ghosts and slipping locomotives, and have always classed them both in the same category.

All the so-called explanations that I have seen given as to the cause of wheel slipping are no explanations at all when they are critically examined. Too much counterbalance might tend to make the wheels slip forward when the weight was traveling downward, but as action and reaction are equal it would retard the wheel to the same extent when it was moving upward.

Then about slipping being caused by the cranks being out of quarter. I can readily understand how that might increase the resistance sufficiently to make the drivers slip backward, or in other words prevent them from keeping up with the rectilinear motion of the carrying wheels ; but I fail to see how a defect of mechanism that introduced a cramping action could impart extra motion to the driving wheels. Common sense reflection will show that driving wheels can not slip without an impelling power being given to them beyond that imparted by gravity, and the forces that were at work before the steam was shut off, and it is as rational to say that the addition of a certain arrangement of weights or of rods would keep a machine running without the expenditure of power, as it is to say that such an arrangement would cause wheels to slip.

There ought to be no difficulty in determining the truth or fallacy of wheel slipping where it is reputed to exist. If I had an engine that was reported to be in the habit of slipping when running without steam, I should put a revolution counter upon her and the record made would settle the case. Furthermore, I am prepared to do the same thing to any locomotive that is reputed to be given to indulging in the slipping habit. It justs suits me to expose shams.

MOTIVE POWER.

Selecting of Places for Holding Conventions.

Editor National Car and Locomotive Builder:

The question of closer relations between the Master Car Builders' and Master Mechanics' associations is being agitated in some quarters. The union of the two has been suggested. "Perish the thought." It will be quite safe to assert that such an idea would not hold water with a majority of the "simon pure" members of either convention. No doubt there may be a corporal's guard among the superintendents of motive power and machinery who have charge of both car and locomotive departments who favor a union. Therefore, an argument on that point would be premature.

There are good reasons however, for a better arrangement for the meetings of the two associations. The evidence so far taken is in favor of both conventions being held at the same place, and on succeeding weeks. Doubtless a very large majority of both associations would favor a move in that direction. The present plan of selecting a place of meeting of the Master Car Builders' Association is not satisfactory. By-law 111 should be amended. As the Master Car-Builders are the first to meet this year, a move should be made by them favoring the meeting of the two associations at the same place and on succeeding weeks. The Master Mechanics would no doubt second such a move. The next question would be, how shall the place of meeting be chosen? Why would not a plan like this answer the purpose? A committee of three to be appointed by each association every year in this manner, two to be selected by the association at the last session, one year the President to be the third member, the alternate year the Secretary. The year the President of the Master Car Builders is a member, the Secretary of the Master Mechanics should be a member, and *vice versa*, the President to be the Chairman of the Joint Committee.

The two committees to meet within six months after adjournment at the call of the chairman, and jointly select a place for holding the next meetings of the two associations; also the chairman to appoint a joint committee of arrangements to include the secretary (who is on the joint committee of selection) and one member from each association, making three. Soon as a place is decided on it shall be announced. A plan like the above will must surely and effectually overcome the difficulty attending the selection and securing a suitable place for the annual conventions.

J. D. MCILWAIN.

Driving-Box Bearings.

Editor National Car and Locomotive Builder:

At the meeting of the Northwestern Railroad Club, as reported in your May number, you took a stand in favor of the half-round brass for driving-boxes. With all due respect to what you have seen and heard about half-round brasses being the most popular, I am prepared to prove that the tendency and prejudice in favor of the half-round brass pressed in is a popular fallacy and a mechanical blunder. No amount of good fitting will make the half round brass pressed in a good wearing job. By putting plenty of work on it, as you describe Mr. C. F. Ward, of the St. Paul & Duluth, to be in the habit of doing, it can be made a good job when finished, but even then the box will not be good for prolonged service. The brass is pressed in by great force, which opens up the lower part of the box. like forcing apart the prongs of a fork. A cut is then taken off the outside of the box to make the sides parallel The box is put under the engine and all is lovely for a few months. Then the brass is thinned down and the pressure that forced out the legs of the box wears off, and the lower part gradually closes as much as it had been forced open. The bearing of the pedestal and shoe is now principally on the upper sides of the box. This leaves openings at the lower sides which lead to pounding and the rapid destruction of the rubbing surfaces. To try to prevent the pounding, the engineer keeps trying to force up the wedges, and that leads to delays from stuck wedges.

I have seen no cause why the solid brass or bronze box should not be the driving box of the future. It is one piece, and that in itself is a strong argument in its favor But as many companies are not ready for the solid box, I would advocate as a driving box bearing three strips of brass with a filling of soft metal between them. That is one of the oldest forms of driving box bearing, and I assert without fear of successful contradiction, that it is the best and cheapest that has ever been used with a cast-iron box. The half-round shell may be more used nowadays, but it does not begin to compare with the brass strips. You are mistaken in saying that the circular brass is a survival of the fittest. It is the survival of the cheapest in first cost, as found by locomotive builders who are more interested in quantity than in quality. Locomotive builders found that a circular brass was the cheapest to apply and they applied it. Master mechanics followed in the fashion without considering the question of durability. I would suggest that master mechanics ordering new engines specify brass driving boxes. There would be some kicking at first, but builders would come round, and in a short time an engine with brass boxes could be bought as cheaply as those with poor cast-iron boxes now are.

FOREMAN.

Notable Locomotive Performance.

Editor National Car and Locomotive Builder:

In order to lay before your readers for comparison the performance of locomotives in different kinds of service, I desire to give you some figures for publication in your valuable journal relative to what is being done on the Minneapolis & St. Louis Railway. In doing so, however, it will be necessary for me to show condition of road, so that the different kinds of service can be properly understood.

We have on our road four hills with average gradient of from 50 to 60 feet to the mile, each hill having an average length of six miles, over which 17 × 24 standard engines are rated and expected to and do pull 18 loaded cars per train. The Minneapolis & St. Louis Railway is so situated in competing for business as not to have one mile of undisputed territory, it being tapped by other roads forming junction points with it every 10 or 15 miles. This, together with the great amount of granger legislation which has been enacted by Iowa and Minnesota of late, and also the Interstate Commerce law bearing down hard upon the company, make it extremely necessary that the mechanical department, as well as all other departments of this road, should be operated as economically as possible in order to make both ends meet. Our engines, both freight and passenger, are equipped with sight feed lubricators for both cylinder and air pumps, with rod guide and eccentric cups of the needle pattern, and every thing necessary to make good showing on oil. Passenger engines have extension fronts and straight stacks, with inside pipe in stack flaring to center from both top and bottom for purpose of aiding combustion, also spark arresting device of a very simple character.

The following description may be of interest, and will give an idea of its construction :

An ordinary sheet of stack netting attached to a basket, which encircles the nozzles at shoulder where attached to steam pipe, running thence to top of smoke arch at an angle of 45 degrees, leaving very large space for depositing cinders in front end, which can be run with while using Iowa coal on trains of from six to nine cars 100 miles without cleaning.

I have given you this summary thus far to enable all readers of the NATIONAL CAR AND LOCOMOTIVE BUILDER to see under what disadvantages we are laboring and the shape we are in for doing good work. I will now give you some figures taken from performance sheet for month of March, which we consider good. Engine 45 pulling cannon ball out of St. Paul & Minneapolis train carded 30 miles per hour, made 176.13 miles to pint of valve oil, 27.48 miles to pint all oils included. Night run both ways, miles run to ton of coal 31 50; average train 6.6 cars, coal per car per mile hauled 9.6 pounds. Engine 47, running opposite on same run, made 242 miles to pint of valve oil, 24.84 miles to pint all oils included; miles run to ton of coal, 31.25, average train 6.7 cars, coal per car per mile hauled 9.6 pounds. Engine 69, pulling time freight between Albert Lea and Minneapolis has an average car draft of 18.8, made 31.76 miles to ton of coal. Pounds of coal per car per mile hauled, 3.3. Engine 70 in chain gang has an average car draft of 15.9; miles run to ton of coal, 34.81; pounds of coal per car per mile hauled, 3.6.

General average of all engine miles run to ton of coal 32.25 miles; run to one pint of oil, 21.14. We are at present using vacuum valve oil with great success, which somewhat accounts for large mileage made on oil.

W. C. HAYES,

Water Circulation in Locomotive Boilers.

Editor National Car and Locomotive Builder :

Your article in the May number on "Boilers for High Pressure Steam," and the report of the paper read by Mr. Leach before the New England Railroad Club, bring again to the front a subject that has many times received the greatest attention from Master Mechanics. Since the first locomotive was built many changes of design have been introduced and now conditions have urged forward new designs to meet them.

A very important consideration in the designing of locomotive boilers, and one which has often been neglected is providing the means of free and unimpeded circulation of water. The more freely the water circulates the more economically and safely will the boiler do its work. The proper utilization of the heat generated in the fire-box and passed through the flues depends greatly on the movement of the water freely upon the evaporating surfaces, and the destructive strains that shorten the life of a boiler are to a great extent prevented by the uniform temperature of material that is maintained by free circulation. The unequal expansion and contraction of parts due to radical difference in temperature are the cause of so much injury to boilers that designers ought never to lose sight of that source of danger and expense. It is impossible to build a boiler which will have uniform temperature throughout in water and material, but much can be done to make the conditions more satisfactory than they usually are.

The method now in common use of placing the water inlet of locomotive boilers is not the best for obtaining free circulations but other considerations are likely to keep the present practice in use. As the greater part of the water is evaporated on the fire-box and at the back part of the flues the most natural place to supply the water would be at the back and bottom of the fire-box. With the present location of the check valve, the water after entering the boiler has to flow in a direction contrary to the flow of heat. With the inlet at the back end the water movement would coincide with the heat flow. It has been contended and conceded that the admission of cold water in the contracted spaces at the back of the fire-box injured the sheets. The objections to admitting the water in the back end were much greater when pumps were used than it is with injectors which deliver the water partly heated, but the objections are still great enough to make the front of the boiler the best point for admitting the feed. This being conceded, the problem for boiler designers to solve is to provide the best means of obtaining circulation through the boiler from that point. This is a most important and difficult task, and its importance and difficulty have greatly increased with the enlarged dimensions of the boiler and the increased work it has to do. The heat imparted is unequal in places. It is hottest in the back portion of the flues and in the front

and front sides of the fire-box. The resulting heat obstructs the backward flow of the water, and the attention of the designer ought to be devoted to lessening, as much as practicable, this obstruction to the free circulation of the water.

In his paper Mr. Leach directed attention to the importance of allowing space between the flues and the sides of the boiler shell for a descending current, and expressed the opinion that steam was formed only on the surface of the water. If this theory were correct, the amount and velocity of the ascendency current would depend upon the water converted into steam and not upon the difference in the temperature of the water. and priming would be unknown. But this theory is held by only a few, while the majority hold that steam is formed into globules in the water in contact with the hot metal, which rise to the surface and then burst. This is believed to be the cause of the ebullition of boiling water; and circulation of water is due to an unequal temperature.

That this theory is correct can be proven by observing the action of water boiling in a chaldron or large vessel under which there is a fire confined to the bottom of the vessel, when it will be seen that ebullition takes place in the center of the water and there is a rapid flow from the center of the vessel to the sides, at which point it descends and flows again to the center. and the bottom. Allow the heat to arise around the vessel and the flow will be decreased but not stopped. This last condition represents the condition of the heat and water among the flues of a locomotive boiler and should remove any doubt about the necessity of leaving space at the side of the flues for a descending current.

The necessity of ample space below the flues arises from the fact that through it must pass the water that supplies the fire-box and a certain portion of the flues. If the theory that there was no current of water in the boiler, except to supply the place of that converted into steam, was correct, then all parts of the boiler would be supplied by the water finding its level through diffusion, and like the sides of the boiler the amount of the space would be of no importance. But we know that that is not the condition. When the water enters the boiler it rapidly sinks to the bottom and flows along to supply the fire-box, and in its passage to that point part is taken to supply the center flues. As the water approaches the firebox end of the flues its temperature increases, which causes the flow to become less rapid and uncertain. A too limited space may, through a sudden increase in the temperature of the fire, and obstruct the flow of water with disastrious results.

The flow of water from the front end of the boiler to the fire-box can be materially aided by allowing an ample bend at the throat sheet, and, if possible, increasing the water space between the flues for some distance beyond the flue sheet.

The next important thing in its relation to, and through it the safety and efficiency of the fire-box, is the shape of the side sheets and the amount of space between them and the fire-box shell. The perfect shape of the side sheet, had not other things to be considered, would be circular or straight, with an inclination at the top toward the center of the fire-box. With either shape, the globules of steam when formed would leave the sheet and their place be supplied by water, which, in its turn, would form steam and rise, as its temperature was increased, and be replaced by other of lower temperature. But, except in one special design of engine and boiler now in use, this is not practicable, and it remains to do the best we can with the present shape and position, which is with the upper and lower portion vertical and the center inclining outward. The vertical position is an intermediate one between the best and the worst, and the position of the outward projecting center, next to a horizontal one with the heat above it, the worst for safety and efficiency, and yet it is one that cannot be avoided without reducing other parts where reductions would be a greater loss than that occasioned by the present form. But changes might be made in it and the outer shell that would give a gradual increase in the water space from the bottom to the top and remove many of the objections to be found where the space is the same width from bottom to top, or but slightly increased at the top. The disadvantage of a narrow water space at this point is greatest at the front of the side sheet

This is due to the great heat at that portion of the sheet, to which also may be attributed the many leaking mud. rings at the front and front sides of the rings caused by the expansion of the sheets, which, being resisted at the top by the stays, force with an equal pressure, down on the rivets at the ring. To this cause can be assigned many broken stay-bolts at the sides. Circulation in a narrow space is perfect, in fact, too perfect, as the small amount of water present rapidly absorbes the heat and becomes of an equal temperature on cross sections, while, if there was more water space there would be an unequal temperature in cross section, with the highest at the fire-box and the lowest next the shell. The result of this would be that the more rapid ascending current would induce the other to flow to the fire-box, and diffuse over different places in its height.

When a side sheet slants outward the globules of steam formed tend through their levity to cling to the sheet until the top is reached, keeping the water away. Increasing the water space will tend to prevent that. Increasing this space also permits the use of large stay bolts, and, reducing the bend of the sheets, allows them to stand nearer to a horizontal line than with the narrow space. The unequal expansion between the front and side sheets compels the stay bolts to give or bend. Where they are at an angle to a horizontal position, in addition to the bending strain as the sheets expand in a straight line vertically, the unequal movement of the two sheets increases the distance between them at the bend, and puts a pulling, as well as a bending, strain on the bolts at this point. This is the reason we find more stay bolts broken there than in any other place. Accepting the necessity of increasing the space between the flues and the sheet with a fixed proportion of fuel and fire-box surface to area of cylinder, means a larger shell than many are now using. JOHN D. CAMPBELL.

The annexed engraving shows an invention of Mr. L. Finlay, a well known railroad master mechanic, for the purpose of holding the piston of a steam engine central while the guides are being lined up. The whole arrangement can be readily understood by a glance at the cut.

Fig. 1

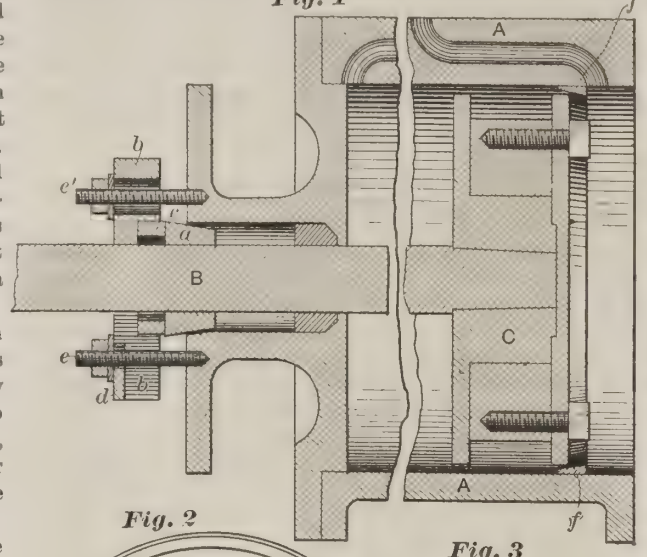


Fig. 2

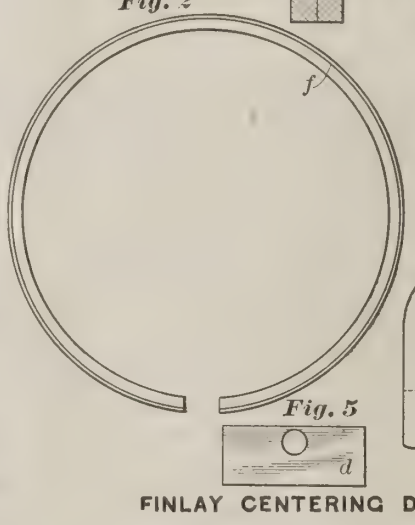


Fig. 3

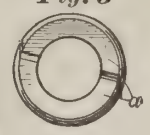


Fig. 4

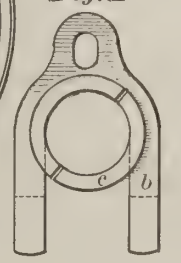


Fig. 5

FINLAY CENTERING DEVICE.

The ring shown in Fig. 2 is tapered and encircles the follower, holding it central, and the ring shown in Fig. 3 goes round the piston rod and holds it central, as shown applied in Fig. 1. Any master mechanic wishing to use this labor and time saving device can obtain full particulars from the inventor, whose address is Little Rock, Ark.

Mr. C. P. Huntington, in a newspaper interview, is reported to have said that he was offered a price for the Chesapeake & Ohio Southwestern property that would net him over four millions of profit on the investments he had made.

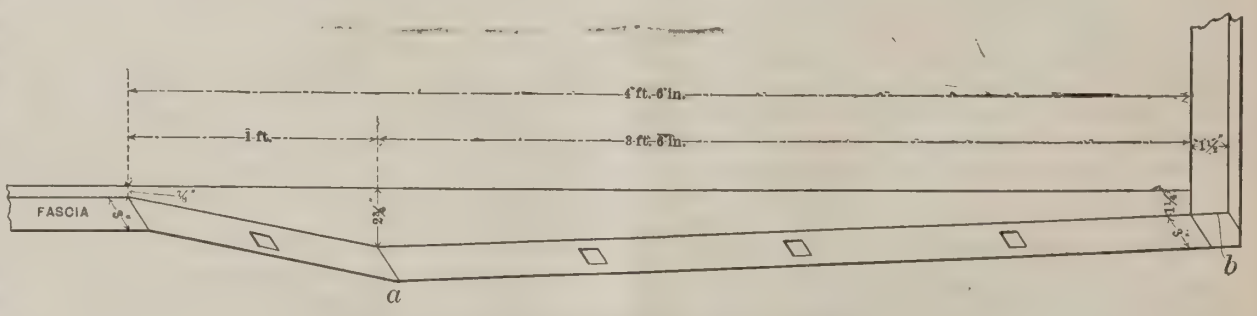
A Well Managed Suburban Railroad.

A representative of this journal lately formed one of a party that accompanied General Superintendent Vreeland over the New York City & Northern Railway. This road connects with the Manhattan Elevated system at 155th street, New York, and runs north and east through Westchester and Putnam counties some sixty miles, passing through that most romantic and picturesque region from whence New York City takes its water supply. The railway follows an extremely tortuous route, the hilly nature of the country making location extremely difficult. After getting out six or seven miles the traveler reaches a country as quiet and sequestered as anything found in the heart of the Catskills, and much of the scenery is equally attractive. Broken, rugged hills, covered with profuse variety of trees and creeping vines, rockbound streams and crystal lakes, are the adornments of a region dotted with small green valleys, where thrifty farmers raise oceans of milk for the city supply. These were the favorite haunts of America's first celebrated writer, Washington Irving, and here are many of the scenes where his characters were located. Many stirring events of the Revolutionary war also happened in this district, and at all points houses and knolls and hollows and graveyards are pointed out that have become of classical interest through their connection with events of the nation's history.

Within the first fifteen miles of New York the road traverses a beautiful, dry, healthy elevated country, convenient to the great metropolis, which ought to be full of homes for those who desire to let themselves and their children breathe the pure air of heaven. The question quickly occurred, Why do those who are crowded in the stifling flats of New York not come out here and build small homes? The means of transportation are all that could be desired. What is the trouble? Land speculators. Nearly all this country is held by "land improvement companies," who are waiting for a rise. Their dog-in-the-manger policy is building up other suburbs of New York, while one of the healthiest and most accessible districts is left for milk raising. It is not surprising that Henry George makes converts.

We have seldom examined a railroad where the evidences of enlightened and careful management are more apparent than on the New York City and Northern. The structure and the rolling stock are in admirable order and Mr. Vreeland prides himself in having these fundamental organs of a railroad in healthy order. We were accompanied by Master Mechanic Millen and the roadmaster, both of whom take commendable interest in maintaining the credit of their departments. The grades on the road are very numerous and reach as high as ninety feet to the mile. The curves are also very numerous and many of them very short. The greater portion of the road is single track. With all these disadvantages a large train service is operated safely. There has never been a collision on the road and the express trains that pass over the whole road and make close connection with the elevated railroad did not miss connection more than four times in the last year.

In the course of an address, before a meeting of locomotive engineers, Mr. William E. Lockwood called attention to a bill, which had been introduced in Congress by Senator Quay and Representative O'Neill, to appropriate $25,000 to the Franklin Institute, of Philadelphia, to enable it to determine the quantity of the so-called hammer blow of a locomotive's driving wheel, in accordance with the report of a joint committee of the Institute and the American Railway Master Mechanics' Association.



PROTECTION FOR FREIGHT CAR ROOFS.

The improvement in freight car construction, illustrated in the annexed engraving, was designed by Mr. A. R. McAlpine, superintendent of the Western Car Company, Indianapolis. In sending us the blue print from which the engraving was made, Mr. McAlpine says:

It will be admitted by most car builders that something is needed to protect the corners of freight car roofs from being knocked off by blows received from the passing of other cars where they do not quite "clear."

Especially is this true of cars having but one course of roofing boards projecting, as is the case with so many of the patent roofs now coming so largely into use.

More than three years ago we applied the device illustrated in accompanying blue print to 200 White Line cars. Many of these protectors have been badly scraped since that time, but the roofs are uninjured.

Having had some requests from the Master Car Builders for blue prints of the protector, I have thought others might wish to use it, and for the benefit of the "guild" I send you a copy which you may publish if so disposed.

It is not an experiment, is not patented; it makes a neat finish, is simple and inexpensive.

The material used consists of oak side pieces 4 feet 6 inches long, 3 inches deep and 1¼ inches thick at end of car, 2¾ inches at *a*, and ⅞ inch at end, which butts against ¼ inch fascia. Oak end pieces 1¼ inches thick, 3 inches deep, meeting at center. The wide fascia should be nailed on before bolting the protector to side plate. The bolt heads should be let in flush and the narrow side fascia run afterward. The end pieces form the narrow end fascia, and may be bolted or spiked on. Saw off the roofing boards at corners so as to allow the side protector from *a* to *b*, and also the end protectors, to project ¼ inch beyond the roof to receive the blow.

Snow-Plowing Contest in April.

The middle of April might be considered an unseasonable time to make tests of snow plows, yet some very interesting trials of snow-working machinery were made on April 16, 17 and 18 last on the Leadville & Gunnison division of the Union Pacific. That division had been blocked up the greater part of the winter with snow that had assumed the consistency of ice, and the Jull Snow Plow Company invited the owners of the Leslie Rotary to make a competitive trial of their machine against the Jull in working through the icy snow. The trials took place on the days mentioned, and the principal innings of the performance is thus described by the *Western Railway*, the editor of which, a practical railroad man, was present:

Nearly all railroad men are familiar with the Rotary, and most have seen a picture, at least, of the Jull. The Jull is intended to capture the snow by means of a screw or auger, which points down to the right hand rail. When the machine is put in motion the revolving screw prances up to the snow at about the same angle a hog assumes when he goes to war; makes about as much noise, but doesn't accomplish as much. The Jull is considerably heavier than the Rotary plow, having a 60-inch boiler, while the Rotary's boiler is but 52 inches, with cylinders and other machinery smaller in proportion. The gauge of the road where the test was made is three feet, and is very crooked and laid with light steel. Very little was accomplished on the first day, as it was nearly all taken up putting the Jull on the track, that big machines having left the rail no less than six times. On the morning of the second day the Rotary was put in the field for the second time and in 13 minutes had cleaned up two miles of heavy snow---almost like ice --which averaged three feet in depth. After getting into deep snow the Rotary left the track twice, and it was not until late in the afternoon that the cause was discovered. The curves were so short that the body of the house would strike the wall or bank, which was so solid that the front trucks were forced from the track. Wings were then bolted on the sides which made the cut four inches wider on either side, and after that the Rotary hung to the crooked rail like a leech.

The Jull was first out on the morning of the third day, but left the channel before she reached the snow. After being jacked onto the rail again she allowed herself to be pushed into the beautiful, where the Rotary had left off at a depth of four feet. This was the first heavy snow encountered by the Jull, and every one was watching breathlessly. Up on the side hill Mr. Jull stood with his photographer, Mr. Mellen, waiting to catch her at the most favorable moment (which never came), while Mr. Leslie, the enemy, stood near with the famous photograper, Jackson, of Denver, and the pictures they made of the poor Jull were actually cruel. Mr. Egan had selected four of the best locomotives on the road with picked crews to do the pushing, but in spite of all this it was impossible to hold the heavy machine up to her work, owing to the bad condition of the track after the Jull had passed over it. It must be understood before we go further that the enginemen were all in sympathy with the Jull and did all in their power to give her a fair trial.

Less than 10 feet was made when the Jull "struggled and strangled and died," but not until she had proven to the spectators that she would not throw snow to the left. The scenery was then shifted, the wheels put on to the rails and another run was made. At noon the Jull had slobbered over 100 feet of track, when she was pulled out and put into the side track.

The Rotary was again put into the field and a great stream of snow was sent up, curled over the telegraph wires and went crashing down through the trees, covering the ground with limbs and pine cones. It was not the intention of the officials to open the road, and after making a mile or so, the Rotary was taken off, covered with snow and glory. The Rotary was stopped several times and photos were made showing the actual depth of the snow and also the condition of the track, after the machine had passed over it.

Mr. S. L. Campbell, general manager of the Princeton, Marion & Ohio River Railroad, died at Marion Ky., April 2', aged 57 years.

Contracts have been let and the work commenced for the erection of new shops for the Chesapeake & Ohio at Clifton Forge, Va. We are informed by Mr. Garstang, superintendent of motive power, that the shops will contain the very best tools and appliances to be found for producing the work accurately and expeditiously.

Mr. R. E. Pettit, general superintendent of the Pennsylvania Railroad, has tendered his resignation. In April, 1868, he was appointed assistant engineer, and held this position until 1879, when he was made principal assistant engineer. From 1881 to 1883 he was assistant chief engineer, and was then made superintendent of the New York division. May 1, 1885, he was appointed to his present position.

The Pullman Company has advanced another step in the direction of overcoming prejudice against American appliances in British railways, by filling a contract for placing two of its cars on the London & Southwestern Railway. These cars, which were built at the company's shops at Pullman, Ill., have been placed in regular service between London and the fashionable watering place, Bournemouth, are 62 feet in length, 13 feet 2 inches high and 8 feet 11 inches wide at the eaves, being thus very much larger than the ordinary English railway carriage, and they are divided into a main saloon provided with luxurious revolving chairs, a smoking room, a boudoir and dressing room for ladies and ample lavatory conveniences. The seating capacity is twenty-eight, consisting of fourteen chairs and fourteen sofa seats, and the cars are vestibuled, this feature being especially a subject of comment and approval, as the vestibule feature is still comparatively unknown in Europe. On their inaugural trip these cars carried her royal highness the Duchess of Albany, after whom one of the cars is named, and a large party of directors and officials of the Southwestern and other railways, and the English press is very liberal and cordial in its complimentary mention of the new vehicle. The introduction of these cars under such promising auspices is the more notable from the fact that Pullman cars were tried several years ago on the Exeter line of the same railway, and given up for want of sufficient patronage.—*Railway Age.*

How an Engineer was Cured of the Whisky Habit.

Tim Williams never understood precisely by what physical and mental process it came about that he loved the beer that bloateth not wisely but too well. He was a jolly, whole-souled fellow, and it gladdened his heart to go round with other railroad men and have a good time. "No harm in a glass of beer," his friends would say, and Tim readily agreed with them. The thing only needed to be kept in its place, and he felt that he was man enough to do that. To be sure, he forgot himself occasionally, but then these were at times when the pressure of friends setting them up happened to be out of the common.

Time wore on, and Tim, who had changed from the left to the right-hand side of the engine, began to think that he would shut down on his beer and the whisky that was now becoming his favorite drink. He had thought this way for some time, and was looking forward to fix on the exact day when he would break right off; but the project was upset by a request that he should call at the master mechanic's office, where he found an order for his time, with the information that he was discharged for drunkenness.

Tim had changed a theory into a condition, and he did not like the change. He drifted West, with the resolution to be more careful when he struck another job. Jovial friends had preceded him, and, on obtaining a position as engineer on the Denver & Rio Grande, he found himself among old cronies, of whom he could truthfully use the words of Tam O'Shanter to Souter Johnnie, "We had been fou for weeks thegether." His resolutions of reformation were postponed for a time in deference to the good company he had found himself among, and the consciousness that, in spite of frequent sprees, he was, by comparison, a fairly sober man. But still he was decidedly like a son of the Emerald Isle who applied for a certificate of character to a former employer. On the request being granted, he found fault with the paper for not mentioning anything about his sober habits. "But I could not truthfully say that," remarked the employer. "Well," said Mike, "you might say I was sober occasionally."

The occasion of Tim's sober days became like the period between the drinks of the governors of North and South Carolina; but he was thinking of trying to shorten them when a badly burned engine sent him adrift again. Tim protested that he did not know what made the crown sheet come down, and Mr. Sample believed him, but did not give him the opportunity to experiment any more, even for the purpose of finding out. These were about the Centennial times, when master mechanics west of the Missouri had not a select choice of engineers, so Tim did not ramble idle a long time. He got various jobs running, and by bracing up a little occasionally managed to hold the reputation of a fairly capable man. And he was a first-class man when he was sober. But he lapsed off sufficiently to burn engines on several more roads, a practice which made the United States too hot for him.

Realizing this melancholy fact, Tim left the dear land of his birth and accepted a job in Mexico. It is not on record how the accident happened, but Tim one day ran over a greaser and was forthwith cast into prison. The prison doors in Mexico do not bear the legend seen at the entrance to Dante's Inferno, to the effect that parties entering had as well conclude that the game of life was played out; but at the day Tim got incarcerated such an inscription would have fitted the case of locomotive engineers who got in for running over anything as valuable as a native or his donkey. Tim languished there for two years on fare that was of an exceedingly primitive character. His bill of fare was said to cost three cents a day, and wine was not included in the menu.

Efforts were made by Tim's railroad friends to get him out by legal process; but months passed and years rolled on, and Tim still lingered in durance vile. At last, impatient with the delays of legal procedure, some of Tim's friends successfully planned his escape, and got him passed into the United States. The flight was effected so precipitately that there was no time for Tim to fix up his wardrobe, so he was landed in New Mexico in the garments that had served him for day and night wear, including Sundays, for over two years. It happened that he had no friends or acquaintances in the place where he landed. He tried to beat his way toward Albuquerque, but was put off the train by a conductor who refused to believe his story, saying that he had heard better yarns than that before from more respectable looking tramps.

He was put off the train in a desolate mountain region, with no sign of life or inhabitant to be seen. Tim felt forlorn, besides being hungry. He sat down on a rough boulder by the side of the track and reviewed his life. He concluded that the "good times" he had enjoyed were a delusion, and that he would be really more comfortable had he never tasted whiskey. He thought of all the time and means he had wasted on this delusion, and contrasted his condition with that of others who had enjoyed none of his opportunities. A bright home and a sweet wife and lovely children appeared as one side of a picture, and on the other a ragged tramp put off the train to starve in the desert of New Mexico. Groaning and in anguish, he formed a resolution, fastened the fragments of his shoes together with a piece of hemp packing he had picked up on the track, and started for civilization and true reform.

He walked wearily but persistently over the arid gravel. Night fell, but the miserable tramp still pursued his way without prospect of breaking his fast with the humblest kind of a supper. When he was nearly yielding from weakness and weariness to lie down and become a prey to the forest wolves, he perceived a light shining through the trees. On approaching it he found a rude hut with half a dozen rough-looking men in it, whom he took to be hunters. He told them his story, and they treated him kindly, although he could see that most of them regarded him as a very fair liar. However, they gave him something to eat, and told him that he might sleep on the floor. This he was glad to do. He had slept soundly for several hours when he was awakened by a tumult among his hosts, and, after some wild scrambling and shooting of revolvers, the din ceased, and he found that the party had been captured by a sheriff's posse. They were a party of horse thieves, and very little ceremony was displayed in disposing of them. There was a tree handy, and the representatives of the law began in a businesslike way to hang the whole gang. Tim was in the party, and he was going to get a share of the treatment given to the others. In vain he protested that he did not belong to the gang. The officers laughed at his protests, and remarked that his yarn was too thin. His clamor was the means of delaying his ascension, and one of the thieves, as he was about to get his neck stretched, informed the sheriff, with whom he appeared to be on intimate terms, that Tim's story was true, that he was merely a blanked tramp. The thief appeared to think that Tim had no right to die in such distinguished company. Be the motive what it might, it saved Tim's neck, but he was taken to jail in San Antonio. Stealing horses was a very serious crime in that locality at this particular time, and as more or less suspicion attached to Jim for the company in which he was captured, he was sent to the penitentiary for five years. It took him nearly two years to find friends who brought the evidence to show that he was innocent of the crime for which he was convicted.

He got out, however, at last. His taste for liquor had got nearly five years in which to cool off, and he did not feel like kindling it up again. Nor had he forgotten his resolutions as he sat starving on the boulder in the New Mexican desert. He went to work on the track to test his strength of will. When he found that he could behave himself properly when free to act as he pleased, he went to a master mechanic for whom he had previously run and told his story. He got a job, and Tim is now one of the most reliable runners on the road, and has a wife who has the right to hold her head as high as any of her neighbors —and engineers' wives in the West hold their heads pretty high if they get half a show. When Tim sees a worthy fireman or young engineer inclined to pass the ruby, he remarks that early glasses, like early apples, are the most dangerous.

The Universal Radial Drill Company, of Cincinnati, O., are as usual busy, having some large orders on hand for their Universal radial drills

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Messrs. Boaz & Maxwell, of Cincinnati, O., dealers in railway supplies, report business as very good, having numerous orders on their books.

The Consolidation Car-Heating Company are making special efforts to have a highly attractive exhibit at the Old Point Comfort conventions.

The Yale & Towne Manufacturing Company, Stamford, Conn., have put on the market a new automatic night-latch, which is simple, secure and convenient.

All balanced slide valves manufactured by the estate of F. W. Richardson will in future be marked with the name of the makers, and buyers are requested to see that their valves received are so marked.

The Springfield Emery Wheel Mfg. Co. announce that they have moved their entire plant to Bridgeport, Conn. New machinery has been added and all the best known appliances introduced for turning out first class goods.

The E. D. Albro Company, of Cincinnati, O., are running to their full capacity, turning out large quantities of veneers of great beauty, to be used in passenger cars, etc. They have in stock some of the finest specimens of mahogany veneers ever seen.

The Lafayette Car Works, of Lafayette, Ind., are building 325 tank cars, capacity 72,000 gallons each, for the American Cotton Oil Company, and 225 tank cars, same capacity, for the Manhattan Oil Company; they are also building for the Kansas City Packing Company 250 Chase Refrigerator Car Company's cars.

The Terre Haute Car Company, of Terre Haute, Ind., are building 300 double deck stock cars, "Hicks' Patent," and have several other orders on hand; they have recently made arrangements to use the Barr contracting chill in manufacturing their car wheels.

The Dayton Malleable Iron Company, of Dayton, O., are very busy, having more orders on hand than ever before. They have again to increase their facilities for turning out work by adding new buildings to their already very large foundry, and have purchased a tract of land at the rear of their present works for that purpose.

The Detroit Foundry Equipment Company, of Detroit, Mich., are meeting with great success with their new devices for use in foundries, whereby the labor in handling the molten metal and flasks is considerably lessened. Among their orders is one for four cranes for the foundry of the Elliott Car Company at Gadsden, Ala.

Messrs. Byram & Co., of Detroit, Mich., among their other orders, have recently received one for a 7-foot cupola from the Union Pacific Railroad, to be sent to Omaha. They have just bought a piece of ground 50 × 140 adjoining their present factory, with the intention of putting up an additional building, so as to increase their facilities and to enable them to keep up with their orders.

The Michigan Railway Supply Company, of Detroit, intimate that they will furnish the New York Central Railroad Company their celebrated "Central" steel brake beam for the 6,000 cars they are about to build. This beam is to be used in connection with the Buchanan truck and the Westinghouse air brakes, making an equipment second to none of the world's manufacture.

The Harrington & King Perforating Company, of Chicago, Ill., manufacturers of perforated sheet metal for use in locomotives and cars and other purposes, and whose works are the largest of the kind in the country, have recently removed their New York office at 100 Beekman street, where they have been for a number of years, to their new office, 284 Pearl street, corner of Beekman.

DENVER & RIO GRANDE.—This wonderful road is soon to be a broad gauge. It has ordered new equipment throughout. All their new coaches are furnished with the improved Scarritt seat, with gold plush, and finished to harmonize with the car interior. The Scarritt Company, St. Louis, are the makers. With these great improvements there will be no more delightful and comfortable rail to travel over in the country.

The American Fire Proof Steel Company have had one of their steel cars running on the Louisville, New Albany and Chicago for upward of a year, and it has given the greatest satisfaction. Railroad men have taken so well to this kind of steel car that several companies have been organized for building them. The latest company has been formed at Bridgeport, Ala., with a capital of $1,500,000. The officers are: President, John S. Long, Louisville, Ky.; Vice-President, F. H. Foster, Bridgeport, Ala.; Secretary and Treasurer, Russell C. Johnson.

The Stone patent oil cellar bearings, manufactured by the Stone & Weiskapf Company, Pittsburg, were recently used on 300 cars, built by the Terre Haute Car and Manufacturing Company. These bearings are making some remarkable records, and are being specified by numerous railroad companies, particularly for passenger cars. It is claimed that the absolute freedom from any trouble, especially that caused by heating journals, has caused many of the best master mechanics in the country to adopt the oil cellar bearing for regular passenger service. A bearing with the same device, but somewhat heavier, is also used for freight car service.

R. MUSHET'S SPECIAL STEEL.—Mr. John Caffrey, master mechanic of the Indianapolis Union Railway, writes to B. M. Jones & Co., Boston: Owing to the great amount of sand used by our engines (switching), our tires are very hard to turn off. Before obtaining "Mushet" we had a very hard time with them. It is the only steel that we have been able to use with any degree of economy.

Notwithstanding the fact that there have been many attempts made to *imitate* the "Mushet's" steels, their excellence appears to be as unapproachable as ever. They are standard articles in the machine shops of this country and Europe.

The annual election of the Hinson Car Coupler Company was held at Des Moines, Ia. It appears from the general manager's report, that 18,280 couplers have been sold during the past year; also that the breakages were officially reported to be a fraction of 1 per cent. It has been decided to establish manufacturing facilities at Eastern and Southern points. The following named gentlemen were elected as directors: F. G. Kammerer, J. E. Forsyth, John R. Walsh, M. S. Bannister, David Secor, J. A. Hinson, W. R. Ankeny, Wm. Christy, with the following officers: F. G. Kammerer, president; J. A. Hinson, vice-president; John R. Walsh, treasurer; Wm. Christy, secretary; David Secor, general manager.

A. Whitney & Sons, Philadelphia, have had 10,000 of their cast iron wheels made for the Savannah, Florida & Western inspected by the R. W. Hunt & Co. Inspection Bureau. The wheels were cast in from fifty to sixty of the firm's contracting shells, subject to all the usual variations of iron common to all foundries. Each wheel was measured around the tread. The records show that 4,325 were of exactly the same circumference, 4,365 wheels were one-eighth inch less than the assumed standard, and 881 were one-eighth inch larger, while 429 varied one-eighth inch each way from the above.

A party of railroad men and others visited Fort Wayne Junction, Philadelphia, on May 16, at the invitation of the Van Dorston Cushioned Car Company, to examine and inspect some cars built for the Philadelphia & Reading, equipped with the coupler manufactured by the former company.

The Long & Allstatter Company, of Hamilton, O., report business as exceedingly good. They have sold large numbers of their punches and shears, and have recently turned out a very ingenious machine, which they call an Automatic Spacing Machine. It will punch two holes at one stroke in a bar of iron 1¼ inches thick, and trim and level them at the same time, and can be arranged at any angle and can space any distance, even to the smallest fraction of an inch.

To correct an erroneous impression, created by the reports that have recently been given out stating "that the Glidden & Joy Varnish Company had sold out for $850,000 to an English syndicate," we beg you, through your valuable columns, to announce to the trade that such is not the case. While it is true thre has been a strong effort made, extending over a period of the past four months, by the representatives of certain English capital to induce us to part with our business, no such transfer has taken place.

We have the largest and most practically equipped (not magnificent) varnish plant in the United States, and from the efforts of many years in the traces have earned one of the largest businesses of its kind in the world, and no such offers as have been made could induce us to part with it. We trust we may for many years have the privilege of serving the same generous patrons who for the past twenty-five years have helped us to make our business what it is, for we believe American capital should maintain American industries.

By this time most superintendents of motive power have learned the desirability of keeping their boilers free from scale and the necessity of removing scale in case any should have formed, and the result is that an active demand has sprung up for boiler cleansing substances. A specialty that has lately attracted great attention in this line in America is "Litofuge," made by the Litofuge Manufacturing Company, of 62 John street, New York. The litofuge compounds are in the shape of an impalpable vegetable powder, and are distinguished by containing no soda, no fatty matter, acids, or chemical elements that might not only clean the boiler but in time leave no boiler to clean. These compounds are known as A. and B., and are disincrustant and anti-incrustant. The first, of course, remedies the harm already done, by removing scale; the second prevents the formation of scale in new or clean boilers. The proof of every compound, however, like that of every pudding, is in the eating; and the Litofuge company are in possession of many testimonials that go to show the "eating" qualities of the compound where scale and impurities held in solution are concerned. Among many testimonials in favor of this compound is one from Mr. N S. Hull, Master Mechanic of the Cumberland Valley railroad, which says: We have been using your Litofuge Compound for upwards of three years in our locomotive boilers. After the A compound had removed the hard scale from all parts of the boilers, tubes and stay bolts, by the use of Compound B no new scale has formed, and the boilers of all the locomotives in which it has been introduced have been enabled to do work which, without the use of your Litofuge Compound, would have been an impossibility.

In no case has there been a failure of the engines to steam; no failure in the working of the machinery, nor the slightest indication of priming.

The Harris Palace Car.

The Wason Manufacturing Company, of Springfield, Mass., have finished a particularly handsome sleeping car, constructed according to the Harris patent. The special aim of the designer of this style of car was to build a drawing-room car for day and a sleeping car by night combined; one that, when not used as a sleeper, has all the comforts of a drawing-room car; that is, easy chairs, good ventilation and plenty of room above and around you. The Harris car just finished meets these requirements, and combines a perfect sleeping car by night and an elegant drawing-room car by day.

We quote the following description of the car from a Springfield paper:

"Mr. Harris was once a newsboy on a railroad, and afterward became a sleeping-car conductor; keeping his eyes open and his mind working, he designed many improvements in parlor and sleeping cars, and every invention known for the comfort, safety and pleasure of passengers is combined in this car. Its outside is especially attractive, being painted a rich Verdette, ornamented in Renaissance and Grecian borders, with panels on which are inscribed the name Jeannette. The steps leading to the cars are of novel design, and the platform, decorated in bronze, can, by dropping an extension, form a balcony. The couplings are interchangeable, so that either the Miller or Jennings can be used. Over the platforms are lamps for oil or electric lights. Inside the coach, every inch of room is utilized. In the left hand corner of the north end is a cozy little closet which will contain the fire tools, and near by a little seat for the porter to rest his weary limbs. In another little compartment will be the electric light switches. In another corner of this car the visitor passes through a door and finds himself in a little kitchen which would delight the heart of a southern cook. In it are contained a boiler, range, and a large-sized ice chest. A little slide opens into a small pantry. Passing back into the passage way, which is large and airy, the passenger opens a little door, not at all obtrusive, because it closes by a peculiar hinge, invented by Mr. Harris, tightly back against the wall. At the end of the vestibule will be found the pantry, men's lavatory, porter's closet and heating room, the system including either hot water or steam from the locomotive. By valves the warmth can be regulated for the sides or center of the car.

The great salon is 32 feet long and nine feet eight inches wide. In one corner a lid lets down and reveals a book-case and writing desk for the literary passenger. The frescoing is especially tasteful, being in four designs, to represent the seasons. The salon abounds in chairs and lounges, all of the same pattern as those used in drawing-rooms. The windows are especially notable for their depth and breadth, and are "bayed" out, allowing the passenger to look a considerable distance to the front or rear. Between the windows are cupboards which will hold French chinaware. At the other end of the salon is a vestibule, out of which opens a lavatory for women, and in a small apartment will be a safe with the same arrangements for keeping valuables as the safe-deposit companies use. A unique feature in another apartment is a dial on which will be registered the speed of the train, the distance the car has traveled, and the number of revolutions of the wheels. A little further along a door opens into a state-room finished in white and gold and containing a wardrobe and a wash-stand with hot and cold water. At the extreme rear of the car is the observation or smoking room, having its walls composed of rare amaranth wood imported from Africa. It is of deep wine color and is said to change in shade with the time of day. The trimmings of the car are of oxidized silver ver. Unlike other sleeping cars, the berths of this one are stowed away in the floor, and are raised by cranks. The berths are six feet long and three feet wide, which is two inches longer and three inches wider than the berths in the ordinary Pullman cars. The floor is so formed as to be a complete steel frame work, which it is claimed would effectually prevent telescoping in case of accident. Through the center provision is made for all brake rods, steam pipes and other appliances. The roof of the car is arched and elliptical, and so gives more head room than usual. Mr. Harris states that the cost of this model palace on wheels will be nearly $30,000.

Our Directory.

Atchison, Topeka & Santa Fe.—John Player is appointed superintendent of motive power, vice Harvey Middleton, resigned.

Atlantic & Danville.—Stuart Wortley has been appointed general purchasing agent.

Atlanta & Florida.—T. W. Garrett is superintendent, and G. S. Howdon, master mechanic.

Central New England & Western.—F. M. Rand has been appointed division superintendent of the road.

Charleston, Cincinnati & Chicago R R.—Geo. W. Bentley is vice-president and purchasing agent of this company.

Chesapeake & Ohio.—Snyder Hall has been appointed manager Kanawha Dispatch at Cincinnati, O. W. J. McKee, assistant superintendent Cincinnati Division, at Cincinnati, O. J. M. Gill has been appointed assisted superintendent Huntington Division at Hinton, W. Va., vice W. J. McKee, transferred. H. Frazier has been appointed superintendent Cincinnati and Huntington Divisions at Huntington, W. Va.

Cincinnati, Georgetown & Portsmouth.—Mr. J. C. McQuiston has been appointed superintendent.

Colorado Midland.—P. J. Flynn has been appointed general manager.

Columbus, Hocking Valley & Toledo.—John S. Patterson has resigned as superintendent of motive power of the road, and has been succeeded by William Miller, of the St. Louis, Vandalia & Terre Haute.

Duluth & Winnepeg.—J. J. McManus has been appointed superintendent.

Mexican National.—Mr. J. Kerr has been appointed master mechanic, with headquarter in the City of Mexico, in place of Mr. W. I. McCammon.

New York & Massachusetts.—J. H. Burghart has been appointed master mechanic.

Northern Pacific.—Mr. John Dorsey has been appointed assistant superintendent of the Idaho division. Mr. F. E. Griffin has been appointed assistant superintendent of the Northern Pacific, Fergus & Black Hills branch. Mr. J. Hewitt has been appointed assistant superintendent of machinery of the Northern Pacific Terminal Company in place of Mr. J. Evans, resigned.

Oregon Pacific.—Wm. M. Hoag, general manager, announces that Mr. E. W. Hadley, superintendent, has been appointed assistant general manager. Mr. J. Stevenson has been appointed superintendent, vice Mr. Hadley, promoted.

St. Louis & Hannibal.—George B. Clason has been appointed general manager.

Union Pacific.—G. W. Cushing, superintendent of motive power, has resigned, and is succeeded by Harvey Middleton.

Wisconsin Central.—John Player, superintendent of motive power, has resigned.

Employment.

WANTED.—Position as foreman boiler maker in a first-class place. Will furnish the best of reference as to fitness. Address H. C., Box No. 3, New Haven, Pa.

WANTED.—A few good car-builders experienced on freight car work. Also blacksmiths and planing mill machine hands. Apply to Ensign Manufacturing Co., Huntington, W. Va.

WANTED—Position by a Master Car Builder. The advertiser is a young married man, with fifteen years' experience in building and repairing passenger and freight cars. Reference and particulars furnishd. Address "W. N. C.," care NATIONAL CAR AND LOCOMOTIVE BUILDER.

WANTED.—A man who has been master mechanic and master car-builder on some of the largest railways in the country for the past nine years wishes to correspond with some railway official with a view of obtaining a similar position. Is a young man, and has excellent recommendations from former employers. Address R. J. M., at this office.

NATIONAL CAR AND LOCOMOTIVE BUILDER

JULY, 1890.

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The West Virginia Central are about to order 300 freight cars.

The Baltimore & Ohio have lately contracted for 3,000 cars.

The Huntington & Broad Top are about to order 300 gondola cars.

The Illinois Central are reported to be in the market for 30 locomotives.

The New York, Lake Erie & Western are asking for bids on 50 passenger cars.

The New York, New Haven & Hartford are in the market for 50 passenger coaches.

The Louisville & Nashville, Me., have closed a contract for the building of 20 locomotives.

The Pennsylvania, Poughkeepsie & Boston are about placing orders for 500 freight cars.

The South Carolina has just given a contract to the Tredegar works for the building of 300 cars.

The New York & New England have contracted with the Erie Car Works to build 1,000 freight cars.

The Cincinnati, New Orleans & Texas Pacific have just ordered eight freight locomotives from Baldwin's.

A car company in Troy are filling orders for the Argentine Republic, Brazil and New Zealand. The export trade is the most important end of the business.

As we go to press the report reaches us that the train men on the Illinois Central at Chicago have gone out on strike owing to a dispute between the train master and the general superintendent.

Mr. F. D. Adams, of the Boston & Albany, is building 50 of the gravel dump cars of his own design. Others of the same kind in use on the road are very highly spoken of by the management.

The Elevated Railroad Company of New York have just ordered 40 new locomotives and fifty cars. Baldwin's have got the locomotives, and the cars have gone to the Wason Manufacturing Company.

Among the visitors at the conventions we noticed Mr. Maher, of Maher & Brayton, car wheel manufacturers, Cleveland, O. This was his first visit in a number of years. Johnnie Bean, from Ohio, also was present.

In reporting a recent railroad accident caused by a broken side rod the reporter makes the engineer say "the main rod on both fly wheels had broken. The main rod is the bar that connects the drive wheels on each side."

At a meeting of the Executive Committee of the Railway Master Mechanics' Association, the secretary was instructed to make a reprint of Annual Report No. 6, the supply of which is exhausted. He was also instructed to make a full index of the matter contained in all the annual reports and have it printed.

The officers of the Philadelphia & Reading Railroad have notified the conductors belonging to the Order of Railway Conductors that they must quit the order since it has changed the rule that forbade striking under any circumstance. It is needless to say that no conductor of the Reading now belongs to the order.

We confess to a feeling of disappointment that the members of the Railway Master Mechanics' Association failed to re-elect Mr. Albert Griggs as vice-president. Although Mr. Griggs has not taken an active part in discussions, he has worked industriously in other ways to advance the interests of the association.

Several of the larger 19 × 24 8-wheel locomotives designed by Mr. William Buchannan for the heavy express trains on the New York Central are at work and doing highly satisfactory service. They pull 12 or 13 of the heavy vestibule cars and run the trains through at the fast express speed without difficulty.

The Chicago, St. Paul, Minneapolis & Omaha Railway will build very extensive car shops at Hudson, Wis. The contract for grading the site has already been let, and as soon as possible the contracts for the building will be let. The engines, machinery, etc., will be ordered now in order that the shops may be ready for occupancy on Oct. 1.

The St. Charles Car Company have recently shipped an equipment of passenger, baggage and mail cars to the International & Great Northern Railway, of Texas, a number of electric motor car bodies to the College Park Electric Belt Line, Sherman, Tex., and a number of motor car bodies to the City & Suburban Railway Co., Memphis, Tenn. They have a large order for coaches for a railroad in Mexico, and also for other roads, so that they are at the present time quite full of work.

The Baltimore & Ohio Railroad Company have been so well satisfied with the performance of a ten-wheel Baldwin locomotive in working the fast passenger trains over the mountain grades that they are going to build ten new engines of the same kind. The engine has cylinders 21 × 24, driving wheels 66 inches diameter, and the boiler carries a pressure of 160 pounds. The particular service required is the pulling of seven or eight cars up a grade 117 feet to the mile, 17 miles long.

The question having been raised at the Master Car Builders' Convention. Why call it the Fletcher lid, Mr. J. Davis Barnett writes to the *Northwestern Railroader* a very good answer. He says: I was draughtsman for Mr. Richard Eaton in 1867 when he patented the lid. A junior office man has not much information about patents, etc., but I may say that the office legends of that time said that the name "Fletcher" became attached to the lid through the energetic advocacy of its use by J. B. Fletcher, superintendent "National Dispatch Line" (National Car Company), St. Albans, Vt.

The Southern members who attended the Old Point Comfort Conventions organized a Southwestern railway club. The officers elected were: President, E. S Marshall; first vice-president, Wm. Garstang; second vice-president, J. J. Casey. The election of a secretary and treasurer was postponed until a permanent place of meeting is settled upon. It is likely that the organization of two or three Southern railroad clubs will spring from this movement. At the meeting called to organize the club, the president *pro tem.* called upon Messrs. E. Chamberlain, Angus Sinclair and W. D. Crosman to give their views on the organization of railroad clubs.

A very serious accident happened to a passenger train on the Baltimore & Ohio June 20 through the breaking of the side rod of a locomotive pulling an express passenger train. By some means the fragments of the broken rod derailed the train, and two cars went over a high embankment. One of the cars, a Pullman sleeper, fell about 50 feet, and was broken in two. It seemed miraculous that any of the passengers in the car escaped alive, but only one of them was killed and eight injured. The framing of the car was almost entirely torn away from the sills. The fireman of the engine was killed by the broken rod swinging round and demolishing the cab.

We learn from Mr. T. L. Chapman, superintendent of moter power of the Central Railroad of Georgia that his people had occasion lately to remove a driving wheel from the axle of a locomotive belonging to a neighboring road. They tried it with a pressure of 180 tons but the wheel would not move. The tire was then taken off, and after that was done a pressure of 95 tons started the wheel. This is a very interesting case indicating as it does the compression exerted by the tire on the whole of the wheel. The wheel centre was 56 inches diameter and the tire 3½ inches thick. It was impossible to tell what pressure it would have required to start the wheel without removing the tire as the limit of the hydraulic press was used.

Railroad companies are the most aggressive prohibitionists of the present day. A month seldom passes that an order is not issued by some railroad manager to the effect that the company has no use for men who indulge in intoxicating liquors. The latest prohibition manifesto comes from the Baltimore & Ohio, and says: "This company will not under any circumstances employ men who are in the habit of becoming intoxicated. All employés known to frequent drinking-places must be warned to discontinue the practice or quit the company's service. Employés will be discharged if intoxicated either on or off duty. No persons discharged for intoxication will be re-employed." The list is continually increasing, and cannot fail to be promotive of more efficient service.

A peculiar collision happened on a Southern road last month, resulting in the wounding of several persons. An engine was uncoupled from a passenger train and started for the coal chute about three-quarters of a mile up the track. It had not gone far when the engineer saw a freight train coming down the track toward him. Seeing that a collision could not be avoided, he reversed his engine and shutting off steam, jumped from the engine, followed by his fireman. The freight engine struck the passenger engine with full force, and the sudden motion opened the throttle valve, and the engine started back toward the standing train at the rate of 40 miles an hour. It crashed into the express and mail car, tearing them from the trucks and sending the tender half way through the car.

At a recent meeting of the Engineers' Society, of Pennsylvania, a paper was read on railroad reminiscences during the war. Referring to the transport of locomotives by the Confederate troops over turnpike roads, the writer of the paper quotes an acquaintance who was military railroad superintendent under Gen. Johnson. This officer says he hauled 160 box and gondola cars from Winchester to Strasburg, about 16 miles, and 10 locomotives from Martinsburg to Strasburg, and all the machinery in the shops at Martinsburg. He afterwards hauled three locomotives and six or eight box-cars 50 miles down the valley, from Mt. Jackson to Staunton, and thence to Richmond by rail. The turnpikes were good, and the hauling was done with from 20 to 40 horses to an engine, according to its size. Locomotives were precious to the Confederacy in those days.

Burnham, Parry, Williams & Co. have taken the preliminary steps which will terminate in extensive enlargements being made to the present plant of the Baldwin Locomotive Works. The old erecting shops on Broad street, south of the present office, will give place to a new shop of modern design, with "saw-tooth" skylights and two travelers, and will extend almost to Fifteenth street, having a frontage on Broad street of 158 feet and on Buttonwood street of 366 street. Adjoining the erecting shop a four-story machine shop will be built, running from Buttonwood to Spring Garden streets, a distance of 208 feet, and from Fifteenth street to the new office building, 227 feet. The office at the southwest corner of Broad and Spring Garden will be extended 47 feet, making the total dimensions 167 feet. In order to make these improvements it will be necessary to remove 75 houses, nine having already been demolished, destroying two courts running off of Spring Garden street, one on Fifteenth street and another on Buttonwood street.—*Railway World.*

For months a box car, that for present purposes may be known as No. 1,458, has been bothering the man who keeps track of the cars on the South Shore road. He has traced it to a certain station, and there all track of it was lost. In the mountainous region of the far West a car has been known to tumble down a precipice and thus become lost, but here such a thing could not happen. The subject of the mysterious car grew upon his mind to such an extent that he determined to find that car or perish in the attempt. Accordingly he went a few weeks ago to the station at which place the car was last heard from, and started after the truant box car. Coming down the line to a point but a few miles above Ishpeming, he went in on a branch to a mine that is a small shipper, and where the track is not kept open in winter. Getting a mile or so out on the branch, he suddenly ran onto No. 1,458, Upon investigation he found that a farmer who lived in the vicinity had been and was still using the car as a barn, there being six horses in the car at the time. It is needless to say that the track was ploughed out the next Sunday, and the farmer's barn is now engaged in the wheat traffic.

Certain men who are trying to be mechanics are trying in vain. Now and then I see a man at work who botches everything he touches. Not long ago I was in a car shop where one of these unmechanical mechanics was employed. My attention was attracted to his peculiar manner of doing things, and I soon saw that he was a man in the wrong place. He lacked the mechanical hand and eye. When he bored a hole through a stick the hole was found to slant. When he sawed the end off a stick he left an end surface that slanted five or six different ways. When he tried to turn a handle, the "finished" article coming from his hands was more like a corkscrew than a handle. When he tried to drive a nail, failure followed. It really seemed that he could split a heavy sill with a shingle nail, while the deft-handed man beside him could drive a railroad spike through a delicate veneer without checking it. The unmechanical mechanic was destroying nearly everything he handled. All he seemed to be able to do was to sweep out, and even at that work he was likely to do some mischief. When a man of this sort has stuck to mechanical work long enough to prove his inability to do that kind of work well, either he ought to have sense enough to understand that he is at the wrong work, or those over him ought to suggest to him a change of occupation.—*Ex.*

Proceedings of Master Car Builders' Convention.

The twenty-fourth annual convention of the Master Car-Builders' Association was called to order by President McWoods in the hall of the Hygeia Hotel, Old Point Comfort, Va., at 10 A. M. on June 10.

After roll call the minutes of the last convention were approved, and then President McWoods delivered the following

PRESIDENT'S ADDRESS.

I am pleased to have the opportunity of again meeting you at Old Point Comfort, and hope that this our second visit will not only be satisfactory to ourselves, but leave such favorable impressions behind us that, should those who may in the future continue our work select this quiet, comfortable, and charming spot for another annual meeting, they may be none the less welcome than we are to-day.

This is the third time your kind suffrages have called me to the chair, with all its privileges, honors, and responsibilities, and I ought to feel at home amid old and valued friends, and among scenery and surroundings made familiar by a previous successful convention; nevertheless, I come to this part of the president's duties with a natural diffidence, for, if I occupy your time at all, I should interest you with a statement of facts or endeavor to make such suggestions for our mutual good as my lengthened and varied experience with the association has given me; but the difficulty I experience is that the comparatively narrow field opened to me has been gone over at least 23 times before, so that year by year this pleasant and appropriate duty of addressing you becomes more and more difficult, and prevents my e er dreaming of bringing before you anything strange or novel to attract your attention.

I am deeply interested in the welfare and prosperity of the Master Car Builders, and I am pleased and proud to offer my congratulations and say that our association and its conventions have not gone backward, either in numbers, interest or in quality of the work performed.

I shall attempt no review of the past year's progress in our specialties, as this will be best shown in the reports of the various committees, and your comments thereon, but from the broad basis of humanity, as citizens of the world we may rejoice to note the increase in brake power now given to trains, the lessened risk from fire to passengers in case of accident, and to life and limb by the growing use of automatic car couplers. We can but feel justly proud of the great strides railroads have made and are making, and the material social benefits they have conferred upon the civilized world by bringing man and man into closer communication and relationship, and conveying the products of one state and country to meet the requirements of another. I see men before me who are foremost in the van of those to whom much of this progress is due. It is improvement in detail that has made railroad transportation in this country rapid, cheap and safe, and it is for the purpose of improving details that our association exists.

By our membership in the association we acknowledge ourselves to be a unit in this one important part of railway life and work. We acknowledge that we have definite ends and aims, and I am proud to say that the ends are not selfish ones, nor the aims personal or local. Nevertheless, we are all apt, in the midst of our many daily worries and cares, to (I shall not say "forget," but) overlook the general interest and the wider ambitions which should distinguish our actions. Perhaps we do not call to our recollection as often as we might, that we exist for the sole purpose of improvement, for a certain uniformity of development that should accompany without retarding growth.

A singleness of eye and purpose with impartial motives have through the world's whole history helped to the attainment of permanent good work, and will, I am certain do so in the work that we have set our hands to do.

If I were to ask each one of you to take a retrospect, and tell me what he has done during the past year, even the most active one would humbly say; "Very little;" and it is the existence of this personal modesty that brightens my hope for the future. It is the man who realizes that he has not yet accomplished his aim, who will strive to attain it and being dissatisfied with the small amount he has done will do better, and more.

It is human to get tired and disheartened, and human is the need to meet now and then, not only because face to face and in conversation, we can accomplish more than we can by correspondence, but because it is good for mutual encouragement, stimulation and mutual education.

Occupied, as most of us are, in active and oftentimes, harassing work, we realize the full value of personal interchange of opinions and experience, and to many the pleasant social intercourse that usually marks our coming together is a needed and welcome relaxation. The mention of the social side of our reunions at once recalls the faces we miss, and the memories of those friends and fellow-workers, who, for a while, were with us but have now ceased from their labors.

I know much is required and expected from the chair to direct and best further the admirable objects we have in view, and, in promising to do my best, I would remind you how much depends on yourselves, and on your co-operation and support.

A hearty and full discussion is earnestly invited on all matters brought before you by the various committees who have given many months' consideration to the subjects, many of which are of the greatest importance and deserving of your best consideration.

It is very pleasant to notice the steady growth and development of the many railway clubs throughout the country. The full discussion and interchange of opinions with the many subjects brought before them, must tend to benefit the parent association.

The very important question of the rules of interchange has received a great deal of attention at their hands and is, I consider, one of the most important subjects brought before this convention.

Since the first general meeting in connection with the rules of interchange, which was held in the city of Chicago in 1875, (and I see before me a considerable number of those who were present at that meeting), it would be very difficult indeed to calculate the benefits that have accrued to railways since the introduction of the system of joint inspection became general, or how much it has done toward facilitating the movement of traffic and removing those obstructions which caused so many vexations and expensive delays. Every member of the association is deeply interested in the improvement of these rules; but let me beg of you to consider carefully any proposed change, and only sanction it for good and sufficient reasons. Many alterations only lead to the confusion of those who have to deal directly with them, and the plainer the language the more easy of interpretation.

With a sincere hope that the present convention will be, in every respect pleasant, and accomplish good work, I thank you for the considerate patience you have given me not only this morning, but during the past three years, and I can assure you that the courtesy and kindness of your officers and members will be ever a green spot in my heart and gratefully remembered.

SECRETARY AND TREASURER'S REPORTS.

The report submitted by Secretary Cloud showed that 141 active, 100 representative, and 6 associate members were on the roll. This was seven of an increase over the membership at the time of the previous convention, The reports of the Secretary and Treasurer showed the association to be financially in a very satisfactory condition.

MISCELLANEOUS.

The roll call at the various sessions showed that there were 97 members and associates present.

An effort was made to reduce the dues for regular members from $5 to $3, but it was decided to keep it for this year at $5.

Mr. J. H. Setchel was elected an associate member.

Mr. D. L. Barnes was proposed as an associate member, to be voted on next year, and later in the meeting Mr. Prout was also proposed as an associate.

Nominating and auditing committees were nominated and elected.

The disadvantages arising from having the place of meeting voted on during the end of the last session having been mentioned, Mr. T. A. Bissell moved that the places for the meeting be nominated on the first day and voted on the next day.

FOR COMBINED ACTION BY M. C. B. & M. M. ASSOCIATIONS.

Mr. D. F. Adams spoke of the trouble, difficulty and dis satisfaction which arose from having the two associations meeting at different points, and he favored the appointing of a committee to confer with one from the Master Mechanics' Association with a view to arranging for the two conventions being held at the same place. There might also be provisions made for bringing the two associations nearer together.

Mr. W. H. Day thought it would be a wise thing on the part of the association to select some central place of meeting and there obtain permanent headquarters. Favored the collecting there of a museum of railway appliances to illustrate the development of railroad machinery. By this means the association would leave some permanent manifestation of the work its members had done.

Mr. Angus Sinclair favored the action suggested by Mr. Adams, but regretted that it could not be carried out this year as the Master Mechanics' constitution defined how the place of meeting should be chosen and that could not be changed without a year's notice. He favored the appointment of a conference committee.

Mr. J. W. Marden favored the suggestion of Mr. Day. He had frequently been asked by general managers why the association did not select some permanent meeting place.

Mr. C. A. Schroyer moved as an amendment to Mr. Bissell's motion, that the places for holding the convention be nominated this day during the noon hour, and that they be voted on during the noon hour of Thursday. The amendment was carried.

After a little more discussion about the desirability of the M. C. B. and M. M. associations establishing closer relations,

Mr. E. B. Wall moved the appointment of a committee to confer with a committee from the Master Mechanics' Association, provided that one was appointed, to see what can be done toward bridging the time between the meetings of the two associations, and bringing the meetings closer together. This motion was carried, and Messrs. F. D. Adams, R. C. Blackall, B. K. Verbryck, John Kirby and J. S. Lentz were appointed as members of the committee.

The following report was then read.

STANDARD MARKING FOR FREIGHT CARS.

To the President and Members, Master Car Builders' Association:

Your committee appointed at the meeting of the Association held at Saratoga in June, 1889, on the subject, "Lettering Freight Cars," would respectfully submit the following report:

Box Cars.

1. The half of side of car on which the doors do not slide to show the name of the railroad company (spelled out in full), the number of car to be placed immediately below it; and when necessary, in order to get the full name of the railroad company, two lines should be used, as shown. The letters and figures used for this marking to be seven to nine inches in height. The light weight of the car, with such other information as it is necessary to give in connection with same, to be placed below number of car, near the sill, using three-inch or four-inch letters and figures.

2. The half of side of car on which the doors slide to be reserved for trade marks when used; the capacity of car and size of journal to be placed near sill on this half of car, using 3-inch letters and figures.

3. The side doors on each side of car to be marked near the top with the initials of railroad company and number of car, using 5-inch letters for initials and 3-inch or 4-inch figures for number.

4. Each end of car to be marked near the top, on the right hand side, facing the end of car, with the initials of the railroad company and number of car, using 5-inch letters and figures for both.

Gondola cars.

5. Gondola cars to be marked on side near the end of car, with the name of railroad company (spelled out in full), and number of car to be placed immediately below it, using letters and figures 6 to 9 inches high; and where possible, in order to get the full name of railroad company on car, two lines should be used, as shown.

The light weight of car, with such other information as necessary to be given in connection with same, to be placed below number on side sill; and capacity and size of journal to be placed near opposite end of car, using 3-inch letters and figures.

6. Both sides of bolster, transom or channel iron in each truck under all cars to be marked with initials of railroad company and number of car to which the trucks belong.

7. Under car, a portion of each outside intermediate sill near center of car, to be painted with brown or black paint, and on this space the initials of railroad company and number of car to be stenciled, using 3-inch letters and figures and white paint.

E. W. GRIEVES,
G. W. DEMAREST,
R. D. WADE.

Mr. Wall wanted to know why nothing was said about the lettering of stock cars, since it was so difficult to establish uniformity with that class of car.

Mr. B. K. Verbryck asked how the marking would be done when it took three lines instead of two.

Mr. E. W. Grieves: I think there would be very few cases where the marking could not be got in, using 8½ and 9-inch letters. If necessary to use a third line, it can be done. Another point the committee had in view was to get the number pretty well down.

Mr. Adams: I would ask the chairman if it is usual to run the doors to the left hand side of the cars, as shown in the cut?

Mr. E. W. Grieves: Some of the roads slide their doors to the left and some to the right. This was copied from the B. & O. drawings, and we slide to the left.

Mr. Adams thought it desirable to establish a practice of marking the length of cars on a particular part of the car.

Mr. W. Forsyth: The lettering on the ends of the car should show the number first and as near the top of the car as possible to enable the brakemen in passing over the tops of cars to take the numbers. The name of the road ought to be on the sill of flat cars.

Mr. Verbryck: Is it necessary to letter the sizes of the journal on the side of the truck?

Mr. Adams: The trucks get changed sometimes, and on that account, he was opposed to having the dimensions of journals marked on body of car.

Mr. Barr: I unfortunately in this special case have to disagree with Mr. Adams. That struck me as really being one of the most useful portion of the committee's recommendations. We are using 4¼ × 8 journal, and sometimes the cars come back with smaller journals on.

There is no objection to putting it on the trucks, but it is of more value on the car—considerably more. This report of the committee puts the road I represent in considerable difficulty. We have a large number of cars running that had coal sides on during the winter. Now our marking would be in the lumber pile if we adopted this method of marking. It seems to me that the main circumstances and requirements of different sections of the country should be met when we adopt and recommend something as a standard.

Mr. Forsyth: I move that these suggestions be referred to the committee, and they present a revised report at a later date.

Mr. G. W. Rhodes thought it desirable that the committee should consider the method of marking stock and flat cars.

Mr. Grieves: Would it be advisable in a revised report to have a marking for the flat car and stock car?

Mr. Wall: That should be in.

Mr. Schroyer: It would be advisable to continue this committee for another year because drawings cannot be made here to show the revised plan. It would be quite difficult to conform to the standards as far as marking is concerned. Our freight departments have a great deal to say. We have some cars that require five lines to mark. I move this as an amendment.

The amendment was accepted by the mover and on motion it was carried.

EXCURSION.

The Chesapeake & Ohio Railway Company offered through their representative, Mr. William Garstang, an excursion by steamer up the historic James River. Mr. Garstang explained that it was necessary to take a whole day for the excursion, and he requested the meeting to decide about it.

Mr. Marden moved to accept the invitation, and that the excursion take place on Friday, after the business of the convention is finished. Motion carried.

NOMINATION OF PLACES FOR HOLDING NEXT CONVENTION.

Mr. T. A. Bissell drew attention to the fact that the time for nominating the places for holding next convention had arrived, and he had pleasure in naming the beautiful and attractive city of Buffalo. Montreal, St. Louis, Chicago, Milwaukee, Denver, Lake George, Cleveland, Pittsburg, Chattanooga, New York and Detroit were also nominated.

The regular order of business having been resumed, the call was made for the report of the committee on

METAL FOR BRAKE SHOES.

Mr. G. W. Rhodes, on behalf of this committee, said:

The committee has not finished its investigations. The committee organized early last year. One of the most important points was to secure facilities for making tests. The matter was taken up with the Chicago lines, and through the courtesy of the Chicago, Rock Island & Pacific line, the committee have obtained promise of every facility in the way of engines, cars, track room, etc. Having accomplished this, the next consideration was, what are the tests to be? As it was a new subject to the committee, we had to feel our own way by making preliminary tests. I hope the association will feel how important it was for the committee to do this. It would have been impossible for me to have named any specific tests without knowing beforehand what the results were likely to be. We therefore appointed subcommittees to make investigations in the shop. We well knew how difficult it is to produce results in the shop which would be corroborated by tests in the service. One of the committees, however, has succeeded in making some shop tests which they have subsequently partly confirmed on the road. An outline of this investigation has appeared in two or three of the weekly railroad papers. If you will refer to this publication you will notice that the comparative friction of the different kinds of metals varies but little in some cases. There is, however, a great variation in the wear of the metals. The problem now before the committee is to make a practical road test which would clearly show this variation in friction. If the momentum of the train being tested is such that the brake power will stop the car in say 200 feet, it will be apparent that, with shoes having little variation in friction, we probably will not show much, if any, difference in the length of stops. But if we can get a sufficient track room and weight of train, then the slight differences which appear in the shop tests will be magnified and reproduced in the road tests.

An important point which has to be considered is how to measure the wear of the two metals in contact. In the shop tests and road tests we can weigh very readily the wear of the shoes, and in the shop the wear of the wheels, but how to weigh the wear of the wheels in service we do not quite know. We expect to make the tests with both the cast-iron and steel-tired wheel. The indications are that there will be little or no wear of the cast-iron wheel. We, however, made a cast shoe with a very hard chilled surface, and curiously enough, the recorded friction of the shoe was equal to that of the soft cast shoe and with very little wear in the shoe. Further investigation developed the wear had been all transferred to the test wheel. It will, therefore, be all-important to weigh the wheels as well as the shoes. We are trying to find out whether we can get weighing scales that will weigh accurately down to ounces, and at the same time weigh a maximum load of wheels mounted on an axle. This will be quite difficult to find. We may have to take the shop tests for the wear of wheels, and waive consideration of this feature in the road tests.

Your committee would, therefore, report progress, and ask to be extended for another year.

The report was received and the committee continued for another year.

Next business was the reading by Mr. J. N. Barr of the following report on

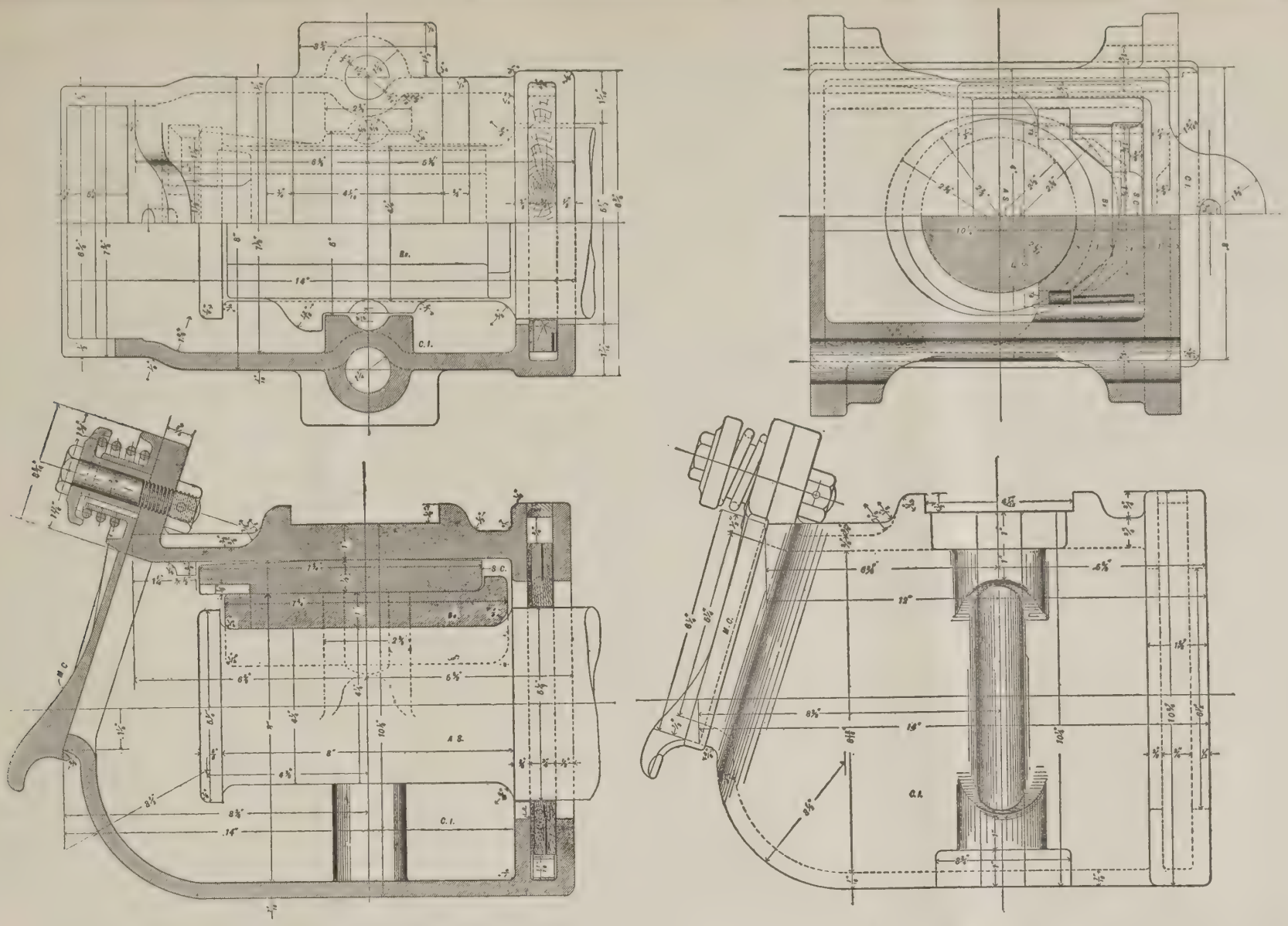
STEAM HEATING AND VENTILATION OF PASSENGER CARS.

Your committee, appointed to report to the association on the subject of Steam Heating and Ventilation of Passenger Cars, beg to present the following:

A circular was forwarded to members of the association, and from replies thereto, the following information and data have been collected.

The information, as far as practicable, has been put in tabular form in the attached statement.

The information gathered from the reports, and which could not be tabulated, is as follows.



PROPOSED JOURNAL BOX, BEARING AND WEDGE FOR 60,000-LB. CARS.—MASTER CAR BUILDERS' ASSOCIATION.

The devices used for regulating temperature are in general shut-off valves of various kinds by which the flow of steam is controlled.

The Johnson Automatic Regulator is used by the B. & O. Railway and the C., M. & St. P. Railway, with very satisfactory results. The N. Y., L. E. & W. Railway used the attachment invented by J. E. Sague, which regulates the flow of steam to radiators as desired. The D. & H. C. Co. use a dial cock which shows amount of steam opening.

As to the comparative merits of direct and indirect steam heat (the term indirect meaning that the steam is utilized for heating water which heats the car), the general opinion seems to be as follows:

1. Direct steam heats up cars in a shorter time than indirect.
2. Direct steam requires a lower pressure in main pipe.
3. Indirect steam gives a milder heat.
4. Indirect steam is less liable to fluctuations.
5. The use of direct steam necessitates careful attention when cars are out of service to prevent the water in pipes from freezing.

As to the relative merits of inside and outside main steam pipes, all reports show that the main steam pipes are placed outside and beneath the cars, with the exception of the C., M. & St. P. Railway. On that road the main steam pipe and connections are placed overhead and inside the cars. The advantages claimed for it being that by this arrangement a more direct communication is effected, the pipes can be so arranged that there is a positive fall for water of condensation from the main pipe, and all radiators to the trap, and pockets for water can be avoided.

The data obtained as to consumption of fuel are somewhat meager.

Tests by the Delaware & Hudson Canal Company show with the Commingler system that an average of 49 pounds of water per car per hour maintained the temperature inside the car 33 degrees higher than the outside temperature, and the temperature of the discharged water was 134 degrees.

Tests on the Chicago, Milwaukee & St. Paul Railway show as follows:

Outside Temperature.	Inside Temperature.	Water of Condensation per car per hour.
40 deg.	70 deg.	70 lbs.
30 "	70 "	85 "
10 "	70 "	100 "

These figures agree quite closely with the results obtained from some tests made on the Old Colony Railway by Professor Lanza for the Massachusetts Railroad Commissioners.

All reports indicate that hose connections are used exclusively. The Baltimore & Ohio, and the Chicago, Milwaukee & St. Paul report using the Gibbs coupling. No reports as to the couplings used by the other roads.

The provisions made for heating up cars in yards consist almost entirely in utilizing some stationary steam producing plant. Car stoves are also used, the first being removed when cars are placed in service.

J. N. BARR,
T. A. BISSELL,
J. W. MARLEN,
J. C. BARBER,
W. H. LEWIS.

Mr. R. W. Blackall thought that more attention to steam couplers ought to have been paid by the committee.

Mr. Grieves mentioned that an agreement had been entered into with his and connecting roads to use the Gibbs steam coupler.

Mr. Marden believed that steam heating had come to stay and considered that any information which could be elicited on the subject would be highly important to members. He favored that the committee be continued with instructions to investigate the subject of steam couplers.

Mr. Wall favored discharging the committee. Believed that the business of heating cars by steam was progressing favorably, and that the time had not yet arrived for establishing a standard system. Minor standards will be adopted by degrees and meanwhile the work of committees is more for the purpose of bringing out information than for advancing the movement toward standards.

Mr. Barr wished for a free and full discussion of this subject. Was especially anxious that the companies struggling over this matter would tell of their failures. Particulars of these would be very edifying and instructive to others who were going through the same experience.

The motion to continue the committee was carried.

Next business was the following report which was read by Mr. Schroyer.

CODE OF RULES FOR INTERCHANGE OF PASSENGER EQUIPMENT CARS.

Your Committee on Code of Rules for the Interchange of Passenger Equipment, in the investigation of the subject for which they were appointed, have encountered a great many difficulties in framing a code of rules which would be equally advantageous to all roads interested, as a result of the varied conditions under which cars of this class are now interchanged.

As regards the interchange of sleeping and drawing room cars, these are run by the railroad companies very largely on a mileage basis, the company operating the cars paying a stated rate per mile for the use of same, and the parties owning cars making repairs to all portions of cars damaged, as a result of natural wear or decay, the railroad companies only paying such portions as are damaged on account of careless handling or accident.

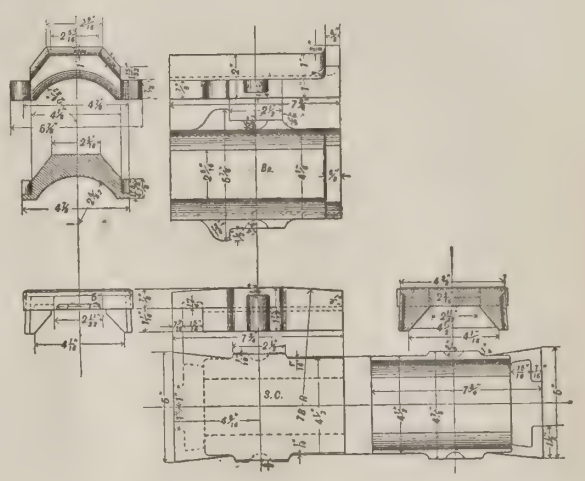
Also cars of this class regularly assigned to the different railroads are maintained on a division basis, whereby the railroad company maintains all such portions of the car as pertain to a day-coach, and all parts damaged as a result of careless handling or accident, while owners maintain such portions of car as pertain exclusively to sleeping or drawing room parts of cars, and where such cars are run it is always under special agreement which could not be controlled to any extent by any general code of rules that could be adopted by this association.

Private or official cars, we believe, are frequently run "complimentary," no charge being made for materials furnished, or for mileage on foreign roads; hence it would not be practicable to adopt a general code that would cover this class of equipment.

The only place where your committee can see that a general code of rules would be advantageous in the interchange of passenger equipment would be, in so far as the interchange of day coaches, baggage, mail and express cars is concerned, and inasmuch as the interchange of these classes of cars is very limited to-day, it was not thought advisable to frame rules covering all the points which could be conceived of, but that a few rules governing the height of drawbar (on which another committee is at work), the condition of the trucks, wheels and brakes, which are the vital points in the safe handling of cars, be recommended, which, if adopted, would reduce to a minimum the difficulties encountered in the interchange of passenger equipment; and as the interchange of passenger equipment increases in volume the rules governing same could be enlarged, as diffiulties may be encountered in this direction.

We believe the present rules governing the interchange of freight cars will very largely prevail in the interchange of passenger equipment, in so far as the general repairs to such portions of the cars as do not affect the safe running of same are concerned.

In considering this subject, your committee did not deem it advisable to recommend the use of what is termed in the freight car code, a "defect card" to be placed on cars to cover such points as need alterations or repairs, but would recommend that authority be given to the road receiving car to make such alterations or repairs, but the road receiving must notify the road delivering cars to them of the changes made, when authority for billing is to be furnished by the delivering road. This point was discussed at length by the committee, and we do not at present see that anything better could be adopted covering this point than the rule as recommended.



The rule in the freight car code governing loose wheels and variation from gauge we considered the proper thing for the interchange of passenger cars; hence the same limits are recommended as in the existing rules for freight cars.

We do not consider that a slid spot 2⅛ inches long (which is the maximum for freight cars) would be the proper thing for adoption in the interchange of passenger equipment; hence a different recommendation in the length of these spots. Neither do we consider that the general condition of the wheel as governed by the freight car code should prevail in this case; hence an alteration in the recommendations in this direction.

In case of steel-tired wheels, your committee considers that the road damaging the wheel should compensate owners for all service metal lost in turning out these damaged parts, and have so recommended.

Three-fourths (¾) inches as the minimum thickness of the flange on a steel-tired wheel was agreed upon, after due discussion and inquiry into the present practices of various roads, in order to have an ample factor of safety to resist all thrusts of the wheel; hence a recommendation to that effect.

We find the practice as regards the minimum thickness at which the steel tire on a wheel can be run safely varies considerably in different localities and in the different seasons; hence it was not thought advisable by the committee to recommend anything less than 1⅛ inches as the thickness of tire at which a steel-tired wheel should be rejected.

Some few recommendations are also made as regards axles to be used under the cars.

As regards tools and supplies carried on special, sleeping and baggage cars, used in the interchange of passenger traffic, the committee does not see its way clear to recommend the adoption of any code of rules covering this point, but considers that it would be very good practice for all cars of this class to be equipped with a tool box in which could be carried four brasses, a set of brakeheads and shoes, one or two pedestals and an equal number of oil-boxes, for replacement while cars are in foreign service. A printed list of supplies carried in the box should be secured to same in such a place as to be easily seen by parties having occasion to use such materials; and foreign roads using materials from these boxes should furnish authority to owners to render bill against them for the same.

Inasmuch as the last convention adopted 70 pounds as the initial pressure to be used on air brakes of freight car equipment, it was thought advisable to recommend that the same initial pressure be used on passenger equipment, and that all brake adjustment of cars be based on the weight of car, and 70 pounds as the initial pressure, as the matter of equalization and uniformity in this direction is one of the greatest importance, and the committee desires to call the special attention of the members to this point, that due consideration may be given it.

We have no recommendations to make as regards the sub-

scribing of members to these rules, which we consider should be printed and added to the freight car code as an appendix.

C. A. SCHROYER,
R. KELLS,
J. H. RANKIN,
J. B. HENNEY,
T. SUTHERLAND.

It was agreed after some discussion and a few minor changes to make the code of rules of interchange of passenger cars formulated by this committee an appendix to the rules of interchange of freight cars. It was subsequently decided to print these rules separately for the guidance of those concerned on the roads which subscribe to the rules of interchange of passenger cars.

Meeting adjourned.

DISCUSSING THE RULES OF INTERCHANGE OF CARS.

The whole of Wednesday's session was devoted to the discussion of the rules interchange of freight cars. The Arbitration Committee had recommended certain changes which were in most cases adopted. The different railroad clubs also made recommendations of change which the Arbitration Committee submitted to the convention. The practice of recommending definite changes, the desirability of which had been thoroughly discussed by parties interested in the interchange of cars, greatly facilitated the business of coming to an agreement at the convention.

As usual, the first vice-president of the Master Car-Builders' Association, who this year was Mr. C. A. Schroyer, presided during the discussion of the rules of interchange. Mr. Schroyer proved himself a highly efficient presiding officer, and the promptness with which the business was concluded was in no small degree due to the manner in which tne members were held down to parliamentary rules.

After some routine business was disposed of on Thursday morning, Mr. J. S. Lentz read the following report on

JOURNAL BOX, BEARING AND LID FOR 60,000 POUND CARS AND LID FOR OLD STANDARD JOURNAL BOX.

The committee respectfully submit for your consideration and adoption the designs herewith of a proposed journal box, bearing and lid for 60,000 pound cars, in which the Fletcher lid may be either of malleable iron or pressed steel. The committee finds it advisable to make a larger journal box than the present standard, and it recommends the change shown in the wedge and brass for the new journal box, because this construction gives a full bearing of the wedge upon the brass, and is less liable to deform the brass when it becomes worn thin than in the old practice of concentrating the load upon the middle of the brass. The necessary clearance for rocking motion is provided between the wedge and the top of the journal box instead of between the wedge and the brass, and the wedge of such strength as will serve to distribute the load evenly over the whole length of its bearing upon the back of the brass. The enlarged journal box has the opening for the lid maintained at such dimensions as would permit the use of the same lid on the new and old boxes by a slight modification in the opening of the present standard journal box.

The committee, therefore, submits also a design showing the same lid whether made of malleable iron or pressed steel adapted to the present standard journal box, and recommends its adoption as standard for that box. No changes are made in this standard journal box except in the opening, which has heretofore been incomplete on account of no means being shown for attachment of lid, and which the committee proposes to complete in such a manner as will permit the use of the same lid as herein proposed for the new standard journal box for 60,000 pound cars.

JOHN S. LENTZ,
F. D. CASANAVE,
R. MCKENNA,
J. N. LAUDER,
A. A. JACKSON.

Mr. Lentz mentioned that Mr. McKenna had signed the report under protest.

Mr. R. McKenna explained that his principal objection was to the placing of part of the pedestal bolts inside the box. He saw no necessity for that arrangement and thought it highly desirable to retain the whole space inside the box for oil and packing. He wanted a new box that would accommodate even a larger journal than the standard now adopted.

Mr. Casanave said that the placing of the pedestal bolts partly within the box was done to maintain the distance between the bolts of the old box. It provided sufficient room for all the oil and waste required, and that was all that was necessary. Their aim also was to keep down the material and dead weight.

Mr. McKenna said that it was 17 years since the standard oil box was chosen, and he thought that the changes that had taken place since that time justified them in now selecting an entirely new oil box.

Mr. Schroyer moved that the box and lid recommended be sent to letter ballot.

Mr. Forsyth noticed that the lid was referred to as the Fletcher lid. He believed the Fletcher lid to be a different device.

Mr. Lentz understood that the lid presented last year was the Fletcher, but the form was defeated. The lid now submitted is of an improved form.

Mr. Bissell had used the Fletcher lid a great deal, but he did not recognize it in the form presented. This was an experimental lid.

Mr. Chamberlain endorsed the views of Messrs. Forsyth and Bissell. This was not the Fletcher lid and its adoption would entail upon railroad companies the inconvenience of carrying two forms of Fletcher lid.

Mr. Barr thought that the most valuable features of the Fletcher lid had been dropped from the design of the lid presented. Feared that it would develop serious defects in service.

Mr. Schroyer considered the lid too complex and would prefer a form they were using, which was cheaper and simpler. He would vote against the lid in letter ballot.

Mr. Rhodes said that the most serious objection to heavy lids was that their vibration wore the seat rapidly. The lighter steel lids had the same defect intensified, and, besides, they jumped out when the wheel struck a low joint.

Mr. Schroyer believed that with a light lid and heavier spring improved service was secured.

Mr. Casanave said that the Pennsylvania Railroad were using a lid similar to that recommended by the committee and it gave entire satisfaction.

Mr. Forsyth moved to have the drawing changed to make the lid coincide more closely to the Fletcher.

Mr. Casanave opposed that, and said that such a lid had been defeated at letter ballot last year. Saw no reason why it should not be defeated again.

Mr. Forsyth insisted that the members did not understand clearly what they were voting on last year, and that a new letter ballot was necessary.

Some discussion ensued about the desirability of altering the drawings, and Mr. Casanave said that he would not do anything more with them. Mr. Forsyth volunteered to make the desired changes, and with that understanding it was voted to send the box, bearing and lid to letter ballot.

Mr. Forsyth then by a digest submitted the following report on

STEEL PLATE AND MALLEABLE IRON IN CAR CONSTRUCTION.

Pressed Steel.

The largest and most important plant in the United States for the manufacture of pressed steel forms for railroad equipment is the Fox Pressed Steel Works at Joliet. This concern is working under the direction of Mr. Samson Fox, of Leeds, England, inventor of the Fox corrugated boiler flue.

It was in connection with the flanging of these flues that Mr. Fox gave his attention to the system of hydraulic pressing, which led him to the invention of flanged forms for use in locomotive and car construction. These forms are produced complete at one heat, with facing strips for the attachment of necessary fittings; and with sufficient rigidity in all directions so as to dispense with the use of angle irons. The regular practice at present in car work, especially in the manufacture of trucks, is to rivet and bolt together pieces of cast iron and wood. Fox's flanged frames are in one piece, and they must possess a superior strength and endurance in service, as compared with built up frames. The quality of the metal is tested in each production, for if it did not possess strength and ductility in a high degree it would not endure the severe stress due to the process of pressing. The metal used is open-hearth steel having a tensile strength of 50,000 to 55,000 pounds per square inch, and elongation of 25 per cent. in 4 inches. The plates are heated to a bright yellow color, and formed in hydraulic presses working at a pressure of 850 pounds per square inch.

The product of the Fox Pressed Steel Co. is familiar to you all. A good example of a truck side frame was exhibited at Alexandria Bay in 1888. Pressed steel center plates made by this company are now in service in large quantities on 12 or 15 different lines. The weight of the plates thus replaced is reduced to less than one-third the weight of castings, and the tensile strength per sqare inch of the material used is three or four times as great, while the ductility of the steel plate renders it practically indestructible, and makes it particularly well adapted to resist the severe shocks to which center plates are subjected.

On account of the expense and delay in making dies, as well as the matter of interchange repairs, it is desirable that a few standard forms for pressed steel center plates be selected and recognized as standard by the association.

The catalogue of the Fox Steel Company exhibits the application of their process to complete freight and passenger trucks and complete Steel Cars.

The Pressed Steel Freight Truck Class D, designed to replace the ordinary diamond truck, weighs 4,600 pounds, as compared with 5,000 pounds for the latter, and the cost of the steel trucks is very little more than the diamond form. Class L is another form of pressed steel freight truck, in which pedestals are used to relieve the frame from the severe shocks experienced in the diamond form where the journal box is rigid to the frame. In this design springs are placed on the side-frames, and the load is transmitted to the journals by the introduction of equalizers. This truck weighs only 5,200 pounds, or 200 pounds more than a diamond truck, but its action on the track as well as its effect on the motion of the car body must be nearly equal to that of a regular passenger truck.

The Schoen Manufacturing Company, of Philadelphia, have been making pressed steel stake pockets and center plates for several years, and they have their center plates on about 7,000 cars. They are now making a pressed steel draw-bar attachment, which is already in use on nearly 2,000 cars. They are also making a pressed steel brake beam. Mr. Schoen has designed a steel gondola car weighing only 18,000 pounds, having a capacity of 60,000 pounds. This car was illustrated in the *Railroad Gazette* of May 23, 1890.

The Schoen Company is erecting a plant in Pittsburgh for their steel specialties for cars, and they expect to commence work this fall. We give illustration of their center plate No. 5, draw-bar attachment and stake pockets.

The Michigan Railway Supply Co., of Detroit, make a pressed steel brake beam called the "Central Steel Brake Beam," which is already used to a considerable extent. The same company manufacture a grain door for box cars made of thin steel plate, and it is now in successful use on several hundred cars on the Michigan Central Railroad. The cost of the pressed steel door is about the same as that of wooden doors with their fixtures. We present illustrations of these two specialties of the Detroit Company.

Malleable Castings.

Our investigations as to the "Use of Malleable Iron in Car Construction," through communication with the manufacturers of the material and the manufacturing car builders would indicate that its use is by no means limited, and that it is extending rapidly. Its use is confined principally to those parts formerlly made of gray iron, but in some instances it is substituted for wrought iron, as will be observed in the attached list of parts now being successfully produced by the manufacturers.

The advantages of malleable castings over the gray iron are greater strength, lightness and durability. Wherever a part is subject to shocks or stresses other than those of compression, the value of malleable castings becomes apparent. The tensile strength of good malleable iron of proper designs is about four-fifths that of wrought iron, such as used in car construction. The facility with which a casting, with many of the properties of wrought iron, can be made, renders its substitution desirable for parts where forgings are expensive or impracticable. That this is appreciated by our designers is shown by its extensive and increasing use in the small parts of cars as shown in the appended list. A reduction in the weight of the parts used in the construction of cars could certainly be obtained by the more extensive use of malleable iron castings. The claims of the manufacturers and users would indicate that, generally, a gray iron casting can be reproduced in malleable at about three-fifths the weight of the gray iron.

Taking the weight of castings now used in a 60,000 pound car, say at 3,500 pounds, the reduction in dead weight would be 1,400 pounds per car, by the substitution of malleable iron. The durability of the material on account of its greater strength will commend it to those appreciating the cost of loss of service of cars on account of repairs to broken parts, to say nothing of the direct outlay of the renewal. The advantages of strength, lightness and durability being apparent, the question of cost arises.

Manufacturers state that for large orders for the building of cars where the malleable iron would be used throughout, it could be produced and sold for 3 cents, or perhaps under that figure per pound. Taking our weights of castings as above, the comparative cost would be per 60,000 pound car as follows:

3,500 pounds cast iron, at $1.80	$63 00
3,500 pounds—1,400 pounds equal to 2,100 pounds malleable iron at 3 cent	63 00

The strength of malleable iron castings depends very much upon proper proportion in designing the pattern. The following rules may, therefore, be of advantage to draughtsmen:

1. Never run abruptly from a heavy to a light section.
2. As the strength of malleable iron lies in the skin, expose as much surface as possible. A star-shaped section is the strongest possible form in which a casting can be made. For brackets use a number of thin ribs instead of one thick one.
3. Avoid all round sections; practice has demonstrated this to be the weakest form. Avoid sharp angles.
4. Shrinkage, generally, on castings will be three sixty-fourths of an inch to the foot smaller than the pattern.

The following is a list of malleable castings now made for freight cars:

Brake wheels, brake wheel ratchets, brake wheel fulcrums, brake lever jaws, brake heads, body queen posts, car door fastenings, various kinds, center plates truck, various styles, corner plates, drawbar stops, door handles, Janney uncoupling castings, label holders, lower swing hang pivots, for swing beam trucks, web or truck end castings, brake wheel hangers, brake pawls, brake beam hangers and clevis, brake hanger carrier, brake shoes, car door trimmings, various kinds, center plates, body, various styles, covers, journal box, drawbars, various kinds dead blocks, door shoes, journal bearing keys, lantern brackets, spring plates, all types, stake pockets, washers, various kinds.

CONCLUSION.

The subject of this report is a general one, not accompanied by any specific instructions. We have, therefore, treated it in a general way, and the only matter requiring any action of the Association is in the direction of standard forms for various details made of pressed steel.

The diversity of shapes and sizes for pressed steel center plates and stake pockets is now almost as great as that for cast iron ones, and the subject should be further considered by a committee on "standards" so that these and other pressed steel details may be reduced to a few standard forms.

In conclusion we desire to emphasize the following facts: First, that malleable iron castings possessing strength and durability, far superior to cast iron and weighing considerably less per car, can, by reason of reduced weight, be purchased at about the same cost per car. Second, that the price of iron and steel beams, channels and plates is now low enough to make it possible to construct a flat, box or coal car of greater strength and durability of equal weight, at a cost very little in excess of a wooden car. Third, the use of pressed steel makes it possible to construct steel cars with few parts and with shapes or forms especially designed and adapted for car construction, of material possessing the greatest strength for a given weight. For these reasons we believe that the extensive use of malleable iron and steel in the detail of wooden cars will result in the gradual disappearance of wood, and that we expect in a few years that iron or steel under-frames and plate steel-trucks will be generally introduced in the United States.

WM. FORSYTH,
JOHN MACKENZIE,
E. D. BRONNER.

Mr. Day wished to hear from those using steel plates instead of castings what their experience was with that kind of material.

Mr. Smith said he had been using steel plates for some time and liked them better than iron.

Mr. Townsend said that the Chicago & Alton had been using steel center plates under cars for the last fifteen years and he never knew of one being broken.

Mr. Blackall then read the report of the committee on

LOADING BARK AND LOGS ON CARS.

Your committee to report on Loading Bark and Logs on Cars respectfully submit the following for loading timber, telegraph poles, spars, etc.:

When two cars are required, one good, sound bearing-piece or saddle must be selected of sufficient thickness to keep timber clear of the car floor throughout, and placed on each car, as shown in diagram No. 3, Plate A; but if the timbers are too short for the saddles to be so placed, they may be brought to any point between the trucks sufficiently near to each other to prevent the shortest from working out between the stakes, two stakes being fixed on both sides of each car in pockets nearest to saddle or bearing-piece, and tied across with telegraph wire to keep the load from spreading, one wire being over the top of the load, one about one-third down, so as to prevent the stakes working or spreading out. The stakes should be made of exceptionally good material.

When a few poles have to be loaded on the top of two cars of short ones, a bearing-piece must be securely fixed across each car on the top of the short poles, to keep the long ones clear, as shown in diagram No. 4, Plate A. Only two of the stakes on each side of such cars must run up, so as to allow them to curve freely.

When the timbers are too long to be safely carried on two cars, a third must in all cases be used, the load to be kept entirely clear of the center car by one bearing piece being placed on end cars, and the whole tied and staked as before described, as shown in diagram No. 1, Plate A. Should there be sufficient timber for two loads, either of which would require a third car, but the total length of which will not be equal to more than five cars, each load may be placed upon two cars with bearing pieces or saddles of sufficient thickness to keep the timber clear of the car floor throughout, at a point between the trucks of each car and near to those next to the end of the load, the fifth car being placed between the two loads so as to cover the projecting ends, as shown in diagram No. 2, Plate A. The timber in this, as in all other cases, must be tied with wire in the manner before described.

The load must not project more than 4 inches beyond the end sills. Care must be taken that the height of the loads be not greater than as shown in diagram No. 6.

When the load occupies more than one car, the weight carried should not be allowed to exceed two-thirds of the capacity of the cars on which the load rests, and particular care must be taken to prevent overloading.

LOADING BARK.

Racks for loading bark on cars are generally furnished by the shipper; which is usually done in the cheapest manner possible and which causes trouble and delays at terminal stations and while in transit. Shippers, however, are willing to have some uniform manner adopted by them for racking cars. Your committee deem it advisable to present the plan shown on Plate B for that purpose for your consideration, and, if the same be approved, to suggest that each road furnish a copy of this plan to the different shippers, so that cars may be racked to conform with it.

Respectfully submitted,
R. C. BLACKALL,
F. D. ADAMS,
W. MCWOOD. } Committee.

The report was received and ordered to letter ballot with the exception of diagram 6.

Next business was the reading of the report on

EXPEDIENCY OF A CHANGE IN STANDARD HEIGHT OF DRAW BARS IN PASSENGER EQUIPMENT CARS.

Your committee has made inquiry with a view to ascertain the present condition of the passenger car equipment on the various railroads, and a table accompanying this report has been made up from information furnished by fifty-two railroad companies, and shows the number of cars, equipped with the Janney, Miller, Cowell and Blackstone couplers. The table gives also the total number of cars distributed under headings showing height of drawbars and the number cars for each, measuring from top of rail to center of drawbar.

There are 13,720 cars reported, and of this number 7,668 cars have drawbars whose height is 35 inches; while there are 4,428 cars having drawbars below this height, and but 1,624 cars measure more than 35 inches. Furthermore, it was found that there were 9,838 cars on which the height of drawbar could not be lowered, and that of the 1,624 cars now having drawbars above a height of 35 inches, 870 could be lowered to conform to 35 inches, leaving but 754 cars out of the total number of 13,720 which could not be lowered without expensive changes.

As is shown above, a majority of the cars have drawbars 35 inches in height, and 4,428 cars are now below this and could be made to conform to it; and as the number above this height is comparatively small, your committee think it is expedient that there should be a change in the standard height of drawbars on passenger equipment cars, with a view to making it 35 inches from top of rail to center of drawbar.

SAFETY CHAINS.

Inquiry into the application of safety chains has shown that there are 9,604 cars on which they are used, and 4,116 cars running without them. As to the form of safety chains and their location, there was found a very great variety in practice, there being nearly as many forms of chain used and points selected for attaching them to the cars as there were railroads using them. The differences, however, were so small that your committee think there would be little difficulty in adopting a standard, and would make as their recommendation the following for a standard for safety chains on passenger equipment cars, viz.:

Links to be made of seven-eighths inch round iron.

One link, 4 inches long by 1½ inches wide, measured inside, to be attached to the right-hand side of platform, facing the end of car.

A chain consisting of two links and a hook, to be attached to left-hand side of platform, facing end of car.

The link of this chain next to the platform to be 2½ inches by 1½ inches, measured inside.

The second link from the platform to be 3½ inches by 1½ inches, measured inside; and

The hook to be 4 inches long, taking the greatest distance measuring from the inside of the eye to the inside of the hook.

The chain made up in this way having a total length of 10 inches. Respectfully submitted,

Committee, { E. D. NELSON, JOHN KIRBY, H. MIDDLETON.

A short discussion on the location of safety chains followed the reading of this report, and was taken part in by Messrs. Nelson, Waite, Bissell, Schroyer, Marden, Barr and Grieves.

Mr. Forsyth offered as an amendment to the report that the height of drawbar be 35 inches when the car is empty.

Mr. Marden thought that the standard so established would not work well in the case of baggage and express cars which went down considerably on the springs when loaded.

Mr. Garstang said that the hook was the weakest part of the safety chain. He favored having a hook on every safety chain, an arrangement that would ensure the chains coupling.

After some further discussion the recommendations of the committee as amended were sent to the letter ballot.

GUARANTEE OF CAST IRON WHEEL.

Secretary Cloud mentioned that an application had been received from the Association of Cast Iron Wheel Makers to make a change in the standard guarantee of cast iron wheels. The request sets forth:

"That in all mileage or time guarantees, the wheel maker ought to be held responsible only for the wheels which fail through faults of material or workmanship.

"That when wheels are taken out of service on account of sharp flanges, flat spots, comby or shelled-out treads, or for cracked brackets or plates, and it is found on breaking up the wheels that the depth and character of the chill and the strength and character of the metal in the plates are up to the standard specifications adopted by the joint conference committee of the associations, it shall be considered that the failure is due to the service, and not to the quality of the wheel, and that the wheel-maker ought not to be called upon in such cases to pay for or replace any such wheels."

Mr. Barr thought that the request of the wheelmakers ought to be carefully considered, and he favored the appointment of a committee to make inquiries concerning the views of members on the subject. He did not favor the request that comby and shelled-out wheels, and those developing cracked plates, should be regarded as fulfilling the guarantee. The severe application of brakes leads to cracking around the plate, but if defective wheels are excused on that account there is danger that the use of inferior material will follow.

It was decided that a committee should be appointed to deal with the subject.

BRAKE GEAR STANDARDS.

Mr. Wall drew attention to the fact that there is some confusion about the proper angle for brake levers. The makers of metal brake beams slot-out the struts at different angles for different railroads, and for that reason they are not interchangeable. He moved that the proper angle be made 40 degrees from the perpendicular, which was agreed to. Mr. Wall also moved that a committee be appointed to inquire into the extent to which the standard air brake rigging is being applied, and to report on any changes or additions necessary to promote its extended use. This was agreed to.

Mr. Schroyer directed the attention of the convention to the fact that the engravings of the brake rigging show the shaft on the wrong side of the car. After some discussion it was agreed to have this discrepancy in the standards corrected.

Mr. Wall moved for the appointment of a committee to ascertain if the M. C. B. type of couplers now being furnished by the various manufacturers conform to the standards of the association, and that they submit a plan for the guidance of the association on the maintenance of these standards, and that the Executive Committee be empowered to issue gauges for maintaining correct dimensions prior to the next convention, if it is considered advisable to do so.

Mr. E. D. Nelson believed that the time had not yet come for the adoption of a standard steam heating coupler, but he believed that great convenience to railroad companies would result from the adoption of standard pipe fittings. He moved that the question of making the fitting on ends of train pipe a standard 2-inch pipe be submitted to letter ballot. Motion carried.

Mr. G. W. Rhodes moved that hereafter committees be required to bring to send in their reports not later than May 1, and that the secretary have the reports printed and sent out before the meeting of the convention, so that members may come better prepared to discuss the reports. Motion carried.

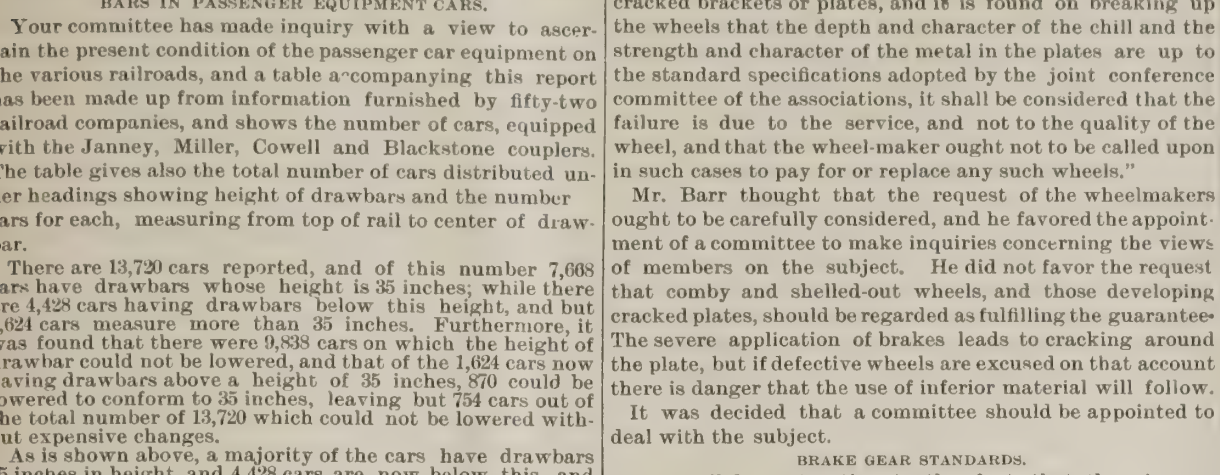
NEXT PLACE OF MEETING.

The vote on the next place of meeting resulted as follows: Cape May, 49; Montreal, 13; Buffalo, 10. The final decision on these three places rests with the executive committee.

OFFICERS FOR THE ENSUING YEAR,

The nominating committee recommended the following officers and they were duly elected:

President, John Kirby, L. S. & M. S.; first vice-president, E. W. Grieves, B. & O.; second vice-president, J. S. Lentz, L. V.; third vice-president, T. A. Bissel, N. Y. C. Sleeping Car Co.; secretary, J. W. Cloud; treasurer, G. W. Demarest, Northern Cent.; executive committee, J. W. Marden, Fitchburg; J. N. Barr, C., M. & St. P.; W. H. Day, W., C. & A.



SCHOEN PRESSED STEEL PLATES.

(*See Report on Steel Plate etc.*

The committee on correspondence and resolutions, consisting of R. D. Wade, E. B. Wall and W. H. Day, reported as follows:

Resolved, That the thanks of the association be tendered to the management of the Hygeia Hotel for the entertainment of the convention, and to the Chesapeake & Ohio Railroad Company, the New York, Pennsylvania & Northern Railroad Company, the Old Diminion Steamship Company, and the Virginia Beach Railroad Company, for invitations tendered to excursions during the convention.

Also to the Pullman Company, the B. & O. R. Co., the R. & D. R. Co., and N. & W. R. Co., for transportation offered to members and their families.

Also that the association appreciates the enterprise of the *Northwestern Railroader* in publishing the daily proceedings of the convention.

The convention then adjourned *sine die*.

American-Built Cars for Europe.

The Jackson & Sharp Works, at Wilmington, Del., are building passenger cars for the railways in France, Spain and Austria. Mr. William Voss, writing about the cars after a visit to the works, says:

They are a curious mixture of European and American practice, and are built according to complete sets of drawings sent over. Of course it is sectional work, like that sent to South America. These cars are about 50 feet long, some of them day coaches and others of the Mann boudoir style of sleeper. They have combination wood and iron sills, *bogie* trucks, the old country draw hook and buffers, etc. All the heater and water pipes are of copper, windows run in brass guides (a very good but expensive thing). There is a vestibule at each end, but they do not touch like ours, being about four feet apart when coupled, and iron aprons and railings form the bridge. The entrance is through the vestibule and steps like ours, but *different*. The exterior is mahogany, natural wood finish. Roof much like ours, and is covered with canvas and sheet copper on ends and at eaves. Some of the cars have been shipped, 6 or 12 more are almost done, and a lot of 6 is just being erected.

Solid End Main Rods.

The Kansas, Ft. Scott & Memphis are having some 8-wheeled engines built, which will be fitted with main rods whose rear ends are solid. Mr. McCrum, the superintendent of motive power, says that his experience with other engines fitted with straps and keys has shown quite conclusively that adjustment is no more necessary at the back end of the main rod than at the ends of the parallel rods, especially if the crank pin journal is of the proper size and the best materials are used. On this road mild steel, case-hardened, has for some years been employed for crank pins, and has proved superior to wrought iron. It is free from slag and from seams, and the only precaution necessary is to avoid such a high carbon steel as would harden to a great depth, and thus prove dangerous. A mild steel, case-hardened, has never broken on this road.

Before the order was given for these engines, Mr. McCrum had found that he could run engines from 15 to 18 months without adjusting the rear end of main rods, and it was this fact which led him to specify solid ends for the new engines. These engines have 17 × 24-inch cylinders, 56-inch straight boilers, and weigh 60,000 pounds on the drivers, which are 62 inches in diameter. The main journal of the crank pin is 5 × 5 inches. He attributes much of the durability of the brasses and pins to the use of hardened steel, and considers that the use of solid end main rods would be an open question if soft steel pins were used. Solid end parallel rods have been in use on this road for a considerable time. Old engines with straps and keys are being fitted with solid brasses as rapidly as opportunities occur. In such cases, the collar of the pin is turned off, and a removable collar is secured with a tap bolt in the end of the pin. New pins have the collar secured by a single nut on the end of the pin, which is turned down and threaded for that purpose. Though but a single nut with 1½"-6 threads is used, and no split key or tape pin is provided, no case of a nut working off has ever been reported. Special care is, however, taken to secure a perfect fitting thread. For the front pin on mogul and 10-wheeled engines, where nothing can be allowed to project beyond the collar, they use a method of fastening, which, we believe, was introduced by the Grant Locomotive Works. The collar has a hub or projection on its inner face which is screwed into the end of the pin by means of a right-hand thread. A bolt with a countersunk head passes through the collar, and is screwed into the pin with a left hand thread. This serves to lock the collar most effectually, unless the threads of the tap bolt should be so poorly fitted as to work loose. There is no tendency of this arrangement to work loose from the friction of the collar against the rod.—*Railway World.*

The entire business of the manufacture and sale of railway heating and ventilating supplies, for many years conducted by James Spear in his own name, is this day transferred to a stock company chartered under the laws of Pennsylvania. The name is the James Spear Stove and Heating Company. Mr. Spear, whose full interest is retained, assumes the presidency, and continues his active personal management of the entire business. The same full line of heaters and ventilators for passenges cars, as well as for mail, baggage, caboose and street cars, will be kept in stock, and additions and improvements constantly made to meet the highest requirements of the railway service.

Richmond Locomotive Works.

In the interval between the conventions the members of the Master Car Builders' and Master Mechanics' Associations, accepted through Mr. William Garstang, an invitation from the Richmond Locomotive Works and visited the works of the company. A special train was provided by the Chesapeake & Ohio Railroad Company. About sixty members of the associations, with their folks and many of the visitors attending the conventions, participated in the trip. The party was accompanied by Mr. Davis, general superintendent of the works, who took a prominent part in working up the excursion. The train conveyed the party to the gate of the works where they received a most cordial reception from Messrs. W. R. Trigg, president; A. H. Raynal, general manager; George Jones, secretary; Major Myers, and other officials.

The visitors found that the works, although comparatively new, are very well provided with the tools and other facilities necessary for building good locomotives by modern processes. The master mechanics in the party displayed a warm interest in the building of some Richmond & Danville consolidation locomotives that were under construction in the erecting shop. This shop is equipped with a twenty-five ton overhead traveling crane which carries all the heavy work required in building. The plan of erecting followed is to put up the cylinders, frames and their attachments the first thing, and after these parts are fastened the boiler is put in. While the visitors were there a boiler for one of the heavy consolidation locomotives was brought by the crane and put in its place, an operation that excited no small share of attention.

The boiler shop of these works is exceptionally well provided with the most approved machinery for boiler construction. They have several very powerful hydraulic flanging machines, which were shown in operation. Nearly all riveting is done by machinery and great care is exercised to turn out first class work. They have a particularly bright superintendent of the boiler shop who displays a most intelligent interest in everything pertaining to boiler construction. A unique tool that attracted much attention in this part of the establishment was a set of vertical rolls for boiler sheets. The rolls are capable of bending the heaviest marine boiler sheets 10 feet wide, and the superintendent holds that they do the work much more satisfactorily than horizontal rolls. The boilers and engines for the battle-ship "Texas" are under construction in the works. The shell sheets are $1\frac{1}{8}$ inches thick, and it takes stiff rolls to bend them. Besides the marine and locomotive works, this establishment turns out a great deal of stationary-engine work, and does a large general engineering business. The railroad companies that are using locomotives built at the Richmond works speak so highly of the durability of the machines that there is every prospect of the company working rapidly into a large railroad business.

Decisions of Arbitration Committee.

The Pittsburgh & Western gave a defect card for four chair timbers defective in a Western New York & Pennsylvania car. When the repairs were made by the latter company a bill was sent in, which included the bolts necessary to attach the timbers. The former company disputed the claim for bolts on the plea that nothing was noted on the card about defective bolts. The company making the repairs held that the old bolts could not be used, and insisted that the claim was just. On the case being appealed to the Arbitration Committee the claim was sustained, the committee holding that the timbers could not be applied without bolts being used.

The International & Great Northern carded a St. Louis, Alton & Terre Haute car with the words "one end bd bk." A bill was rendered by the latter company for the renewal of one end of the car. The company giving the card refused to pay the charge, claiming that only one board was broken when the defect card was put on. The other company claimed that the whole end was destroyed and that the charge made was correct. On the case going to the arbitration committee, it was decided that the carding company was liable only for the one broken board noted on the card. If greater damage was inflicted on the car, it was the duty of the receiving company to see that particulars were noted on the card.

The New York Central carded a Boston & Albany car for a bent truck frame. In the bill for doing the repairs the Boston & Albany charged 50 cents per hour for blacksmith and helper, and the carding company challenged the correctness of the bill, holding that, according to rule 25, the rate specified for labor was 40 cents. The Boston & Albany claimed that the charge made was for the actual money paid out in performing the repairs. On the case going to the arbitration committee it was decided that the rate specified in rule 25 must be adhered to, and the objection was sustained.

The New York, Lake Erie & Western rendered a bill against the Chicago, Burlington & Northern for replacing two pair of wheels on account of the axles being below the prescribed limits in the center. The latter company refused to pay, claiming that the axles were foreign and had been applied on some other road. The point was made that if the charge was proper, a company had no remedy against the substitution of wrong material. Claim was also made that the margin of safety in the axles was sufficient not to justify their removal. The arbitration committee held the C., B. & N. liable for the payment of the charge, but recommended that the rule be changed to read, "axles less than the prescribed limit in the wearing parts."

The Baltimore & Ohio Shops.

During a recent brief visit to Baltimore we had the pleasure of walking through the shops of the Baltimore & Ohio Railroad with Mr. G. B. Hazlehurst, General Superintendent of motive power of the company. We had visited the Baltimore & Ohio shops before, and found a Chinese-like spirit of contentment with past achievements pervading the place that was not conducive to progress. That spirit appears to have been exorcised, for there was a decided air of enterprise about the establishment, and the spirit of lethargic contentment has been taken by one stirring with ambition. The ancient tools and antediluvian methods are no longer pointed to with overweaning pride. In fact, some of the venerable tools have gone to the scrap heap, and others will follow in due course. A reorganization of the shops is going on, and when the work projected is finished the shops will be as well provided for doing work economically as any railroad shops in the country.

They are building 35 engines in the shops and a great deal of heavy repairs is going on, so the works are employing more men than there have been in the works since the financial troubles overtook the company. In the works is a large building that formerly was devoted to bridge construction. The company are now buying their bridges and the bridge shop is under conversion into a boiler shop for which it will be well adapted. They are building a tower for the hydraulic riveting machinery, and a full equipment of rolls, shears and other boiler making tools will be put in. The present boiler shop will be made an erecting shop for locomotives and the present erecting shop will be filled with machine tools.

The oldest roundhouse in the country is in these works. It is 60 years old and is as much a curiosity in its way as the locomotives with upright boilers that are still used for switching purposes about the shops. The building will soon be pulled down and a shop more in accordance with modern requirements built in its place.

Allowance for Expansion of Frames.

A correspondent writes us: "Will you kindly give me the correct rule for expansion per foot to be allowed in putting up solid ended side rods?"

We referred the above question to a master mechanic who has had exceptionally great experience with solid ended side rods, and he says:

In answer to the attached inquiry I would state there is no rule that I am aware of for expansion, nor do I think there can be any, for this reason that were a rod made longer it could not be put on when the engine is cold, and if it could be put on after the engine was hot it would have to be taken off when the engine was to be cooled, or else the rod or the pins would have to spring when on the center or near it. Again, the amount of expansion in the frames is not constant, but depending on the variation of the heat in the fire-box. The upper bar is the one receiving the most heat. The under bar receives but little, in fact none of any consequence on an anthracite coal burner. Another thing is that the amount of frame under the influence of the heat in the fire-box fixes the amount of expansion between the centers of the wheels. On a soft coal burner, say with a 7 foot fire-box, this would be greatly different from that of an anthracite coal burner with an 11 foot fire box.

Again there is a certain amount of expansion due to the rod when working. This from the heat of the pins and the heat due to friction of the rod passing through the air.

I always found it necessary to give a certain amount of play in the bore of all solid end side rods. The amount of that play I never found constant. For instance, where the side rod goes on the outside of the main rod we can expect a little variation in the quartering of the wheel, *i. e.*, in the distance from the crank pin center to the center of the axle.

Again, a little inclination one way or the other in the bore for the crank pin may cause further deviation on the extreme end of the pin. For that reason, where the side rods, where outside of the main rod, I found on a four or four and a half inch pin that it was necessary to give each brass a full 3-64 play, *i. e.*, bore it out a 3-64 larger than the pin. Where the side rods were inside of the main rod, then made it a full 1-32, and never found that it was too large; but I have found engines in which it was necessary to give more play in each instance.

You will readily see that by boring each end $\frac{3}{64}$ larger than the crank pin, that it allows for $\frac{3}{32}$ expansion of the frames over the side rods, provided everything is all right. I have found no trouble in putting on the rods on a cold engine, or after the engine was warmed up. We can expect a little inequality in a pin even if new, also in boring the brass, and this again answers for these inequalities as well as for any defects in the quartering of the wheels.

It is very clear that if we should allow for expansion it could hardly be less in an 8-foot rod than a $\frac{1}{16}$. This would give us, if the bush in the pin had worn to a bearing, from $\frac{3}{32}$ to nearly $\frac{1}{8}$ of an inch, and if the frames expanded we would have that amount of play in the rods when the engine was hot.

I think you willl find there are very few rods that allow for any expansion for the above reasons, and that the amount of the play in the bush is what is depended upon, and what that amount must be will depend upon the class of engine. An anthracite coal burner has only the top bar exposed to the influence of the heat from the fire-box. If that bar stands off the fire-box a little the expansion will not amount to much, and against that expansion must be the resistance of the lower bar, which receives but very little heat. On a soft coal burner both bars are exposed to more or less heat, and then but for a short distance. On a fire-box extending over the top of the frames, we generally find about an inch between the bottom ring and the frame. In that case there is very little heat communicated to the frames.

You see here we have three instances which would require different rules, if there was a rule required. I know it is held by some that there must be a certain amount of expansion in the frame, and that the side rod should be made to allow for it, but I believe what little there is, is amply provided for in the play given in the bush and in the play between the box and the wedges. If this expansion amounted to much it would certainly be greatest on an anthracite engine, and then what would be its effect upon the bottom bar, which does not expand? The top of the pedestals would have to be shoved over, which, no doubt, is the case, to a certain extent, and is one of the causes of wedges becoming hot and sticking.

Uneven Wear of Brasses.

All the master car builders and others who are familiar with the maintenance of cars are aware that with oil boxes fitted with the Bissell stop wedge, the brass wears much faster in the inside than on the outside end. Mr. R. D. Smith speaking at the Western Railway Club of this peculiarity said: We have found them to wear to such an extent that when the inside of the brass would be worn to half an inch thick, the lead would not be worn down at the outside. In looking the matter up it was thought that the pedestals were out of square, and that caused the uneven wear. We squared up the pedestals, but that did not seem to remedy the trouble. We then took some cars that had just come from the shops, the pedestals of which we knew to be perfectly square; and, after two trips, we found that all the brasses were worn all out on the inside, and not at all on the outside. I believe what we want is a journal box that will feed clean oil to the journal.

Mr. Verbryck: I have found in my experience that to throw the equalizer $\frac{3}{16}$ inch off the center is just enough. Theoretically, directly over the center is correct, but practically it is not. After considerable experiment I finally found that throwing the equalizing bearing forward of the center was just right.

Mr. Smith: I don't think throwing it out $\frac{3}{16}$ inch or $\frac{1}{4}$ inch would make much difference. We find that the wedge is from $\frac{1}{4}$ to $\frac{5}{16}$ inch from the shoulder of the box, which would allow it to move considerably. The last thing we have done is to take the Bissel brass and plane off $\frac{1}{8}$ inch toward each end, which gives it a crown, and leaves a bearing right in the center. I have some brasses thus cut on trial now.

More About Snow Plows.

Mr. C. P. Jones, President of the Cyclone Steam Snow Plow Company, in the *General Manager* for June says: "We know from observation that there is great room for improvement in any steam plow yet tried, and all the bosh about 'certain plows cutting through ice,' etc., is only disgusting to railroad men who know the actual truth; and the truth hurts no one." In view of the fact that the *Railway Age*, the NATIONAL CAR AND LOCOMOTIVE BUILDER, and other leading railway journals of the United States copied our account of the test made last April on the Union Pacific, we take this opportunity to state that the account was true. When we wrote what we published we had but one object in view—justice to all. We agree with Mr. Jones that "there is great room for improvement in any steam plow yet tried," but we claim that we did "stick to the truth" when we said the Rotary plow went through snow that was "almost like ice." Mr. Jones says further: "We believe we have the correct principles in the Cyclone." We hope so, in fact we have often (in conversation with railway men) expressed the belief that the Cyclone was the coming plow—we said so to Mr. Leslie at Alpine Pass, but he laughed at us. Well, it was his day to laugh. We have never had the pleasure of seeing the Cyclone work, and, of course, can say nothing from actual observation about that machine. Mr. Jones states also that his company has brought suit in the United States Court, at St. Paul, against W. H. Truesdale, who bought a rotary for the Minneapolis & St. Louis, to restrain the use of Leslie's new wheel.—*The Western Railway.*

Work Done by the Master Mechanics' Convention.

So much of our space has been devoted to reporting the proceedings of the Master Car Builders' Convention, which was held a week earlier than that of the Railway Master Mechanics', that we can give but little space this month to what was done at the latter meeting. Next month we expect to give a full account of what was done.

President Briggs called the meeting to order and requested the Rev. George Royel to invoke the divine blessing on the meeting. President Briggs then introduced Mr. Ingalls, president of the Chesapeake & Ohio, who delivered a most eloquent, historical and interesting address of welcome, his principal theme being Virginia.

PRESIDENT'S ADDRESS.

President Briggs then delivered his inaugural address as follows:

Brethren of the American Railway Master Mechanics' Association, Ladies and Gentlemen:

In the name of our honored society I rise to give you a hearty greeting.

As we follow the example of our locomotives in the power to move from place to place, it is eminently right and proper that our convention should meet at "Old Point Comfort," where a new application of mechanics was successfully demonstrated by the genius of Ericsson in his famous monitor, awakening and revolutionizing the navies of all nations. It is to Ericsson that we also owe the screw propeller, now in our day enabling the "greyhounds" of the ocean to plow the deep, transporting the people of all continents with such speed as to annihilate space and challenge the admiration of the world.

This man struggled to impress upon the minds of the scientific men and the capitalists of England, the advantages of the screw propeller, and was forced to abandon his efforts for want of encouragement; but in this country, where genius never applies in vain, the worth and value of his invention was recognized and appreciated, resulting in the steamship "Princeton" being equipped with that then called myth, now recognized as one of the greatest agencies of mankind in the locomotion of the steamship from shore to shore.

The prosperity of our country since our last assembly has been attested by a large additional railroad mileage, and we learn from reliable sources that more miles of new railroad will be built this year than in 1889. When we reflect that the extreme boundaries of our country are already connected by existing railroads, from the oceans that bathe our Eastern and Western shores to the Canadian and Mexican limits, we see at once that our railroads are not to reach new territory in any great bound, but are in the natural development of our internal country; and we, as master mechanics, have for our special work, not the creation of any new machine to accomplish locomotion, but rather the evolution of our present engine, that we may reach the highest efficiency in speed, in power, in durability and in safety, at the least cost in its original construction, combustion properties and expense of keeping up.

While the old wood-burning engines have generally given way to the modern coal burner, it is quite probable that in some sections of our county other fuel than coal may be successfully used, and we invite from all sections the suggestion of our associate mechanics to this important item in the cost of steam making.

The great diversity of territory through which our locomotives travel would seem to prevent anything like national uniformity in construction; severe grades demanding features in the engine not required over prairie country, and other special forms provided for use in special localities; but when we travel through our country and see the different locomotives at work, we cannot but be struck with the great similarity of these powerful machines, and we feel a glow of pleasure in the knowledge that the existing uniformity and excellence has been attained more through the labors of this association than from any other influence. This thought inspires us with confidence in our progression, and we look forward to our annual convention in the full security of individual improvement as members, and enlarged and enlightened service for the companies we represent.

As we contemplate the immense work that our locomotives have been made to perform in the transportation of the harvests from the prairie to the seaboard, in the movement of all living and dead freight, creating cities, establishing markets, breathing life and civilization, making the "desert even blossom as a rose," let us not forget the grand army of faithful engineers and firemen to whose care these vast machines are entrusted; an army of men larger in numbers, stronger in discipline, richer in intelligence and higher in bravery than any of whom Alexander could ever boast. These men, largely recruited from humble life, form a perpetual monument to the mothers who gave them birth, true type of our American womanhood, who sent her boys to school and struggled so often with poverty and privation that her children should have every opportunity for gaining knowledge, and who by a lifetime of devotion has encouraged and fortified us all in the development of our progression.

Let us thank God for what has been gained, but let us not think that everything has been gained; much has been done, but much remains to be done. Science is daily improving our knowledge as to the combustion of fuel; mechanics is daily improving the learner in the care of these machines. It is not necessary now as in former days, when you and I were young men and members of the rank and file, to search after this knowledge—by the aid of a tallow candle perhaps: the knowledge thus obtained by those early pioneers of progress has been so concentrated and compiled that it is now within the reach of all; a few cents will place those most precious thoughts within the grasp of the student. Let us unite in our endeavor to educate our men in their profession; inducing them as far as practicable to read and think over the scientific literature flowing towards them. Animated with such knowledge coupled with their daily experience, the evolution of efficient service to our companies, must result and we and they will have an enduring place in the history of our progression.

Your committees have labored diligently with the work assigned to them at your last convention, and we bespeak for their reports your earnest attention, making special reference to the one on the compound locomotive.

We do not pretend to any knowledge in the untried future; we would not at all be understood as desiring to frown upon any advanced idea tending towards development and progress; we place an abiding trust in your intelligence and sagacity, and earnestly hope that you will devote such far-reaching inquiry and consideration to this subject as will enable you to successfully cope with the question in all its bearings, that all its salient points shall stand revealed; for which this association shall reap its full measure of honor and credit.

I should be derelict in my duty, ungrateful to this association, and untrue to myself did I not publicly refer to my election as your president one year ago, an honor ever to be remembered by me with the most affectionate gratitude. The cares and labors of an active life, in a rapidly developing section, with a fast growing business over both mountain and plain, have demanded such unceasing attention that I fear my share of your work has not received that constant activity that should been bestowed upon it; still I have faithfully endeavored to fulfill the trust you reposed in me. In all my correspondence with your committees and members I have received the heartiest co-operation, and I am especially indebted to our secretary for his valuable assistance.

To Mr. Sinclair, mechanical engineer, well versed in theory and experienced in practice, educated in his profession and cultured as a gentleman, at one time speaking to us as an editor through the medium of the art preservative of arts, and now as Secretary of this Association, I now openly tender my grateful thanks, and close my address invoking upon your labors in this convention the fostering care of Divine Providence.

Reports were read on the following subjects and interesting discussions were excited by several of them: Compound Locomotives; Efficiency of the Link as Compared with other Valve Motions; Advantages and Disadvantages of Placing the Fire-Box above the Frames; Exhaust Pipes, Nozzles and Steam Passages; Relative Value of Steel and Iron Axles; Brick Arches in Locomotive Fire Boxes; the Best Means and the Economy of Preserving Locomotive Tanks from Corrosion, and the Best Form and Size of Axles for Heavy Tenders.

The officers elected for the ensuing year were: President, John Mackenzie, New York, Chicago & St. Louis, Cleveland; First Vice-President, John Hickey, Milwaukee, Lake Shore & Western, Kaukauna, Wis.; Second Vice-President, Wm. Garstang, Chesapeake & Ohio, Richmond, Va.; Treasurer, O. Stewart, Fitchburg Railroad, Charlestown, Mass.; Secretary, Angus Sinclair, NATIONAL CAR AND LOCOMOTIVE BUILDER, New York.

Maintaining and Utilizing M. C. B. Standards.

During the discussion of the Rules of Interchange of Cars at the Old Point Comfort Convention, the subject of Standards came up and Mr. G. W. Rhodes, of the Chicago, Burlington & Quincy said:

I would like to say something on this question, because I believe it is one of the most important subjects that has come up before our association and that it covers a great deal broader scope than appears on the surface. This Association is intended to represent progress and to bring about more economical methods of handling railroads. At the last time we met at Old Point Comfort, the Association, through hasty action, passed a very remarkable decision without a dissenting voice, and that was putting air-brake hose in the category of locks (Rule 8). Locks and air-brake hose, when used, were to be at the owner's risk and consequently to receive no protection. When the rules had been all passed upon, a motion was made to reconsider this action, and by unanimous vote air-brake hose was crossed out.

The question is frequently raised as to what is the use of the standards of the M. C. B. Association, and I think it is a matter to which we can well afford to give a little time. A friend of mine not very long ago—he is not sitting very far from me now—said that the M. C. B. standards were a good deal like ostrich eggs—that when completed they were dropped and left to take care of themselves. Now it is unfortunately the case that this has been about the way that the M. C. B. standards have been cared for. I think, however, that the association is beginning to realize that its standards are not ostrich eggs, but eggs from the barnyard fowl, and if you drop them and do not take any further interest in them you will not hatch any chickens. You will all agree with me, I think, that the standards of the association are becoming far too important to be treated in this way. We find that the Chief Magistrate of the land is taking up questions that have come before our association. In an important standard, which has been the subject of much discussion before senate committees in Washington, it has been found that there are hardly two manufacturers of the device conforming to the associations, figures and drawings. That this should be the case is mainly because the device has been considered by the Association an ostrich egg, and nobody has been looking after it. Now I think if the Association will take some action by which it will make these standards more important than they are now, so that we will be more interested in them and take greater care of them, I believe we will bring about entirely different results. Under the recommendation of the Western and Central Railway Clubs I cannot see where there is any objection or where any one may fear getting improper material under his car. The proposed rule says distinctly in repairing damaged cars M. C. B. standards may be used when of design and dimensions that do not impair the strength of cars. Let us see what the practical working of this will be. Suppose that on our line we have a Southern Pacific car that needs some repair which an M. C. B. standard will meet, in lieu of the cars, original construction. Now under the present condition of things we cannot apply a M. C. B. standard to that car, but we must either make a pattern or else we must send to California for it, and when it comes back to us at Chicago in addition to the serious delay to the car, we have a considerable freight bill to pay.

Suppose on the other hand that there is an agreement with the Southern Pacific road by which they will accept in lieu of the cars original construction the M. C. B. standard. We would substitute the M. C. B. standard, and they would get their car more promptly and we would have no freight to pay. When they would get one of our cars precisely the same thing would happen. Now, suppose they do not want to maintain that car with the M. C. B. standard, all they have to do is to remove the M. C. B. standard and put their own construction on, and hold the M. C. B. standard to repair our car or some other car which is subject to this arrangement. As a matter of fact, this is the way many of the raiiroads are doing now. Our road has interchanged in this way for three or four years past, and a great many other lines are doing the same thing.

If you will recollect, before we passed our present ruling about air-brakes, a number of roads, for their mutual advantage, clubbed together, because the association would not put it in their rules, and agreed to arrange for interchanges in the matter of air-brake material, and I take it that if the association does not pass on this matter now, as recommended by the Western and Central clubs, you will find that different members of the association will club together and they will agree among themselves to accept M. C. B. standards, and that will simply be postponing the day when the association will adopt this very rule.

There is another point in connection with this. At present the executive committee is undertaking the handling of the M. C. B. standards. Some time ago they undertook also to handle the arbitration disputes between the different railroad companies. It was found that the work was too much, or at any rate it was conceived by the association that it would be better if the arbitration cases went over to a committee, and I think that we have occasion to feel satisfied with what the arbitration committee, since its inception, has done. At any rate, from recent action in discussing these rules this morning, it would appear that in the few questionable cases that have arisen, the association thoroughly endorses the arbitration committee's action.

The time is coming, and I believe it is here now, when the association must take more interest in these standards. Its standards are becoming too important to take care of themselves. I think it will not be long before the association will appoint a committee to look after its standards. When it does that everyone will have an interest in these standards, and they will get more generally introduced. I know what some of the objections at present are. One of them, for instance, is that with the the Master Car Builders' shoe we cannot tell what the standard is and many object to getting a casting which is not representative in any sense other than in general appearance. What action are we taking to bring these standards to greater perfection?

Take the subject of couplers, of brake rigging, of brake beams. In all these standards there may be many changes that it is desirable should be made, and if we had a committee that we might refer any suggested changes to it would help very materially. Now, I think if we pass this rule and allow M. C. B. standards to be used, even in their present imperfect condition, there will be no quicker way of bringing about perfection.

I would say, in answer to the gentleman who wished to know why the Arbitration Committee made no recommendation in the matter, that it was because the Arbitration Committee was equally divided. At our last meeting there were only four present; two were in favor of the Western Railway Club's recommendation and two were not.

Winter and Summer Cars.

The St. Charles Car Company has recently completed a combination winter and summer car for the Lindell Railway Company, of St. Louis, which will prove the feasibility of combining the two ideas and enable street railway companies to have only one-half the rolling stock required to operate their lines with the old system of separate closed and open cars. This car is constructed upon the plan of the ordinary street car and measures 7 feet 6 inches wide by 16 feet long over posts and end sills, respectively.

The lower window sashes of the side and end of car are made to drop down between the outer and inner lining of the car. The top window sash, which is made in one length with malleable casting at the ends, and thin iron strips across the division mullions through which the window sash is secured against the side of the car by means of small joint bolts, having the nuts let into the post and secured to prevent their being lost. These window sashes can be piled very closely together, requiring very little room for storage. The holes in the post after removal of window sash are filled out by the joint bolt, which has only to be turned in so that its head covers the bolt hole. Filling pieces are provided to close the open space between the posts which form an arm rest of very liberal basis. The ends of car are arranged with the usual sliding doors; the end windows are made to drop down, thus affording a continuous current of air while car is in motion. The window sashes in the raised roof are pivoted, and can be easily opened at the will of the passengers, and afford the lateral current of air.

The interior of the car is finished in San Domingo mahogany with neatly furnished ceiling; the seats and backs are of new reversible pattern on each side, with a passage way through the center of the car, accomodating 24 passengers, which is two in excess of the capacity of closed cars with side seats. The center aisle also admits of quite a number of passengers, who can steady or hold themselves by means of pendant straps. Hartshorn roller window curtains of special woven tapestry are provided to protect the passengers against inclement weather and strong rays of sunlight, both winter and summer, and these curtains need not be removed, except when damaged. The trimmings and lamps are made of solid bronze. The car is illuminated by one improved center lamp and two end lamps, all of which are fitted with the adjustable globes. The body and dash board grab handles are made of iron and covered with vulcanized rubber. The platforms are equipped with gravity safety gates, conductor's seats, hand-brake and radial drawbar. The exterior is painted with St. Charles Car Company standard body color of a deep orange and the ornamentation is executed in dark and light gold leaf and finely finished.

"One of the latest pieces of startling news sent out in the press dispatches was to the effect that a train on the Union Pacific drawn by a mogul locomotive was run at such a high velocity to make a meeting point that the driving wheels melted.—NATIONAL CAR AND LOCOMOTIVE BUILDER.

That's easy. A reporter for a Denver paper was on a Burlington train a few weeks ago, when the engineer made 60 miles in 50 minutes, including a stop to take out a main pin that was inclined to run hot. Yes, we have some very speedy runners here in the hideous and heathery West.—*The Western Railway.*

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

JULY, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Master Car Builders' Convention.

The proceedings of the Master Car Builders' Association in the Old Point Comfort convention were principally confined to the performance of routine work. There was nothing brought before the meeting of a specially interesting character, and nothing about which particular diversity of views was held; but nevertheless it was a successful convention, and the members present devoted themselves with laudable industry to performing the work to be done. We publish the various reports elsewhere in this issue, and a good condensed report of the discussions, so that the large portion of our readers which was not present can obtain a good idea of what was done. The reports submitted by the various committees all contained valuable information although they did not all make recommendations for the adoption of standards. The work of the Master Car Builders' Association has been devoted so much to the furtherance of standards, that some members of the organization appear to think that a report which fails to recommend standard parts is of little value; but these persons ought to remember that a full and thorough investigation of every subject is a necessary preliminary to the recommending of standards, and that recommendations made without proper consideration are liable to lead to serious mistakes. The association has come to a period when it is much more important to care for established standards than to recommend new ones.

The act of adopting a standard by the association is of little benefit to railroad companies if it is not generally adopted, and there is is good reason for believing that had half the energy devoted to getting the members to agree upon certain standards been expended in converting railroad officers concerned to the desirability of applying the standards to their rolling stock, the cause of uniformity and interchangeability would be much more advanced than it is. Mr. E. B. Wall, who may generally be depended upon to move in the right direction, instituted the following of a wise policy in moving for the adoption of a committee to submit a plan for the guidance of the association in the maintenance of standards, and the cordial support he received indicated that the members present were fully alive to the importance of the matter. There was serious opposition manifested to the increase of standing committees, but we feel assured that calm reflection would convince the members that a standing committee for looking after the standards could perform duties that would be as valuable to the association as those done by the arbitration committee.

The warm support given by the members to the motion of Mr. F. D. Adams, calling for the appointment of a committee to confer with a committee of the Master Mechanics' Association, about holding both conventions at the same place, proved that the members are little frightened with the dreaded vision of one association swallowing the other. There appears to be such a friendly understanding between the two associations nowadays that we think it is very probable that the motion made by Mr. Wall and adopted, calling for the appointment of a committee to confer with one from the master mechanics regarding the advisability of shortening the time between the conventions will result in a change of dates for the holding of the two conventions. Sweltering in the heat for four days at Old Point Comfort waiting for the opening of the second convention must have exerted a most convincing influence upon those who went through it, as to the desirability of having the conventions closer together. If the two associations would agree to the proposal made by the master mechanics to have the M. C. B. convention to meet on Wednesday and the master mechanics the following Monday it would enable members of both associations to take in both meetings in eight days. The change would be certain to materially increase the attendance at both conventions.

The beneficent work performed by the Arbitration Committee was the means of greatly promoting agreement respecting the changes proposed on the rules of interchange of cars. Never before since the rules came up for discussion have they been settled so promptly. This was in no small degree due to the admirable manner in which C. A. Schroyer, who was Chairman of the meeting, held the members down to business. Considering the decided ability which he displayed as a presiding officer, we think the nominating committee made a mistake in failing to present his name again as Vice-President.

Master Mechanics' Convention.

Those who bear in mind that the purpose of the American Railway Master Mechanics' Association is "the advancement of knowledge concerning the principles, construction, repair and service of the rolling stock of railroads" are likely to conclude that the 1890 convention has been as successful as any of the past meetings, The convention was fortunate in recciving a splendid opening. The address of welcome delivered by Mr. M. E. Ingalls, president of the Chesapeake & Ohio Railway, was an eminently interesting oration, and the fact that the head of one of the greatest railroads in the country had taken the association by the hand, so to speak, had a very happy effect upon those present. President Briggs' opening address was eminently practical, sensible and appropriate, and made an excellent impression. His definition of the duties of the association were to the point, and his declaration that the members had urgent duties to perform as teachers as well as learners struck a note that found warm sympathizers. The kind words which President Briggs spoke in behalf of the men who bear the heat and burden of the day in performing the difficult duties of operating railroad machinery, will exert a harmonious influence between the Master Mechanics' Association and the rank and file of railroad employés. The spirit of helpfulness and conciliation has not been always offered so freely as might be desired.

There were reports read from seven committees and some of them were exceptionally good papers. That on compound locomotives will compare favorably with any paper ever submitted to an engineering society. The members sat very patiently in session for five hours each day, and the work was pushed forward without undue haste, but the business to be transacted was too voluminous for the three days devoted to the convention. The consciousness that so much work had to be gone through ptevented the reports from receiving the attention they deserved.

Nearly every speaking member at the convention could have given information of interest, had discussions followed the reports on exhaust nozzles, on link motion, on the placing of fire boxes above the frames and on brick arches; but little or nothing was said about these reports because members were afraid that the work to be done could not be finished in the three days. At every convention there is pressure put upon the committee of subjects to introduce a long list of subjects for investigation, and it is difficult keeping down the volume of projected work. We think, however, it would be more conducive to the interests of the association and of those who derive benefits from the work done, if the number of subjects to be investigated were regulated to suit the time available for discussing them thoroughly. Some of the best work done by the association has been in the discussion of subjects brought up at the noon hour, and on the first day of the Convention the noon hour was well spent in the disdussion of mogul locomotives and other topics; but the necessity for expediting the work curtailed the topical discussions on the second day and cut them off entirely on the last day of the session.

A notice was given two years ago of an amendment to the constitution requiring the elections to be made without nominations. For some reason the question was not brought up last year, but on Mr. Setchel moving at the Old Point Comfort convention that the amendment should be adopted, it was evident that he had the sympathy of the meeting, although the change was vigorously opposed by Mr. Forney and other able debaters. From the character of the voting that was done when the election of officers came on, we should judge that the change is likely to result in the election of those who work hardest for the association.

The disappointments of the convention were the absence of reports on Purification of Feed Water and on the Car Coupler question. There are several parties offering very promising mechanical feed water purifiers, and they appeared to think that their interests would have been promoted had the subject come up for discussion. Another year devoted to the collecting of information about methods of purifying feed water will not be wasted. The association does not lose sight of the fact that the investigation was undertaken in the interest of railroad companies. The verbal report which Mr. Hickey made on the attitude of the committee in regard to the car coupler question was as much as reasonable persons could expect at present.

The Master Mechanics' Convention had a narrow escape from a premature finish at Old Point Comfort. On the forenoon of the second day when the members were in session, smoke was seen escaping from the wooden lining of the hall, and it was found that a chimney had started a fire in the frame-work of the building. It was extinguished promptly, but had there been no one in the hall at the time, the probability is that the hotel would have been burned down. Two years earlier there was another narrow escape from having the hotel burned at Thousand Islands.

The Railroad Accident Death Roll.

We have received from Mr. Edw. A. Moseley, secretary of the Interstate Commerce Commission, and published in another column, a report showing statistics of railway accidents for the year ending June 30, 1889. The plain figures showing the injury and death that happened in the operating of railroads during one year are given without embellishment or comment, but in all their nakedness they reveal a most appalling story. The grand total is 5,823 persons killed and 26,309 injured. This represents the result of accidents spread over a vast territory and throughout an immense railroad mileage; yet it discloses an aggregate of death and suffering which ought to appeal to every mind imbued with human sympathy.

The majority of persons killed by railroad trains were not employés of the companies or passengers traveling on the roads, but to both the latter classes there was a very high percentage of accidents. The railways in the United States carried 472,171,343 passengers during the year, and one passenger in every 1,523,133 was killed, and one in every 220,024 injured. For the same year in Great Britain one in every 6,942,336 persons carried was killed, and one in every 527,577 injured. From this it will be seen that there is about three times the risk of railway passengers getting killed or injured in the United States to what there is for travelers in the United Kingdom.

There is a prevailing belief that more railroad employés are killed coupling cars than in any other way, but this is not correct. There were 300 persons killed while coupling cars, and 558 killed through falling off trains or by being struck with overhead obstructions, which proves that passing over the tops of cars is the most hazardous part of a railroad man's duties. The introduction of automatic couplers and of continuous train brakes will to a great extent prevent the loss of life from the two causes mentioned. These are the only improvements calculated to prevent accidents that railroad companies are carrying out with any degree of energy. There are other improvements almost as urgent that could be carried out with comparatively small expense and are neglected because public sentiment or patent interests are not urging them into use. In the list of accidents, 107 passengers are generally shown to have been killed and 445 injured in collisions. From other sources we learn that a considerable number of fatal collisions were with trains standing at stations unprotected by signals. There is no life saving practical appliance that our railroad managers neglect so universally as they do station signals. There is not a railroad on the American continent whose system of station signals would pass the English Board of Trade requirements.

One of the most surprising items of the death roll is the number of persons killed at stations. There were 424 persons so killed, 328 of them having been neither railroad employés nor passengers riding on trains. This happens through the free and easy way that people have of crossing the tracks on the level at stations. There is a belief among railroad managers that the average American citizen is competent to care for his own safety when given the opportunity to avoid danger, but this permission to commit involuntary suicide is carried in many cases far enough to lay those who are presumably responsible for the safety of people who go to railway stations, open to the charge of criminal carelessness. The laws regulating the safe operating of railways in Britain and in other countries, where the government displays a wise desire to protect the lives of the people, prohibit railroad companies from permitting passengers to cross the tracks at stations on the level. Means must be provided to permit passengers to cross above or below the track. This rule is enforced even at roadside stations. A few of our most progressive railroad companies display a disposition to introduce this highly desirable practice at suburban stations, but other companies doing an immense suburban passenger business make no provision whatever for the safety of people going on and coming off the trains. There are railroads connecting with nearly all our principal cities that carry daily a very large number of suburban passengers, and in many cases trains are run with very little time apart. Yet there is no more provision made for the safe handling of this highly remunerative business than there is on the railroads running through the most sparsely settled districts of Nebraska. There is no efficient platform accommodation, and at every station on the roads the passengers have to go on to the middle of the track to climb up on the cars of trains running in one direction

This is inviting accidents, and is the kind of near-sighted policy which gives political demagogues arguments in favor of putting railroads under strict state control.

Accidents at highway crossings killed 437 persons. The increase of trains and the acceleration of speed combined with the growing density of population contribute to make highway crossing accidents every year more numerous. Within the last week we have noted in the morning papers accounts of three accidents of this nature wherein eight persons lost their lives. In some of our most densely settled States the dangers of highway crossings have become so fully realized that the legislatures have taken measures to compel railroad companies to raise or depress the crossings away from the track level. The cost of effecting changes of this kind has been exceedingly burdensome to the railroads concerned, but few persons, with human sympathies, will deny that the improvement was necessary and urgently demanded. The need for more legislation of the same kind is growing rapidly. If railroad companies would display a little more inclination to use the means within their reach to prevent accidents at highway crossings, there would be fewer of them, and public attention would not be excited into compelling the companies to adopt far more expensive preventatives which will certainly be the case where the do nothing policy is carried to its natural end. There are several very efficient mechanical appliances for protecting highway crossings and for giving warning of the approach of trains that effectually prevent accidents where they are used. The introducing of these safety appliances and the removing of obstacles which obstruct the view of the track from the approach of bi-secting road-ways would materially reduce the death rate from crossing accidents. The statistical department of the Interstate Commerce Commission is likely to exert a strong educational effect upon public opinion. Railroad companies will have themselves to blame when this opinion is roused to demand that expensive measures be taken for the protection of life.

Plan for Using the Boston Fund.

Among the members of the American Railway Master Mechanics' Association who take a hearty interest in the welfare of the organization, there has always been considerable uneasiness manifested as to the final disposition of the Boston Fund. There is every indication that the plan of disposing of the fund indicated by the adoption of a resolution introduced by Mr. J. H. Setchel will receive the cordial support of the association. It is an excellent plan, and will, if carried out, make the fund of substantial practical service in the course of higher mechanical education. The resolution reads: "That a committee of three members, consisting of J. N. Lauder, J. N. Barr and Angus Sinclair, be, and are hereby appointed, empowered and directed to confer with the trustees or other proper officers of the Massachussetts School of Technology of Boston, the Cornell University of Ithaca, N. Y., and the Stevens Institute of Technology, Hoboken, N. J., for the investment of the Boston Fund of this association in one or more scholarships in these institutions, and to submit a report for the approval of the association. The benefits of said scholarships to be given for such time as maybe directed by the association as a prize to sons of members who shall exhibit the most valuable attainments and skill in the development of locomotive mechanics."

We believe that this method of disposing of the Boston Fund originated with Mr. Jacob Johann, and he has for years advocated it privately, but until lately met with so much opposition that no move was made to bring the scheme before the association. The methods of disposing of the fund that were pitted against the scholarship plan, were one to establish a mechanical laboratory and another to establish permanent headquarters for the association. We have given the latter plan some support, but we believe that devoting the fund to the education of sons of members is far preferable, and we have no doubt that the greater part of the members will think so likewise.

Printing Committees' Reports in Advance.

Both the railroad mechanical associations have adopted resolutions requiring that committees having subjects under investigation send in their reports to the secretaries not later than May 1, and instructing the latter to print the reports and forward them to members not later than June 1. This is a very important change and brings the railroad associations into line with the practice that has been very profitably followed for some time in other leading engineering societies. There was for some years a prejudice against printing committees' reports before they were read, owing to the belief that that big bugbear the newspaper reporter would have the reports published prematurely.

The secretaries of engineering societies generally make the request in sending out papers that they should not be printed until they are read, and we have never known of the rule being violated, but it would matter very little if it was not adhered to. An engineering report is a very different thing from a political manifesto. The more that is known about a report when it comes up for discussion the better. The subjects treated in these reports are sometimes so abstruse that considerable study is required to prepare the facts and data required for discussing them properly, and this cannot be done during the few minutes that the reports have hitherto been in the hands of the members before discussion begins. Printing the papers and putting them in the hands of members at the time the reading of them began was a great improvement over the practice of merely reading the reports; but it is not nearly so satisfactory as the plan that would enable members to read over the papers at home where necessary information upon the points raised could easily be obtained.

We predict that the new rule will lead to more general discussion of the reports submitted, and that the information presented in the discussions will be of greater value than it was under the old practice. When a master car builder or master mechanic is suddenly called upon to discuss statements made in a report, he has to depend entirely on his memory for facts, and the uncertainty about being correct prevents many from speaking. The industrious, modest member, who never will speak unless he is absolutely certain that he will make no mistake in facts or figures will be encouraged to come to conventions loaded up with valuable information.

We only hope that the chairmen of committees will obey the resolution and send in their reports at the time specified. From some little experience in laboring fruitlessly with chairmen of committees to induce them to send in reports by June 1, we are led to fear that a good many of the reports will not be forthcoming at the date specified.

Helping the Adoption of Standards.

In another column will be found the report of a most interesting and suggestive speech which Mr. G. W. Rhodes delivered regarding maintaining Master Car-Builders' Standards during the discussion of the Rules of Interchange of Cars at last convention. In our issue of last month we directed attention to the necessity for some committee or officials to exercise authority in seeing that supposed standards were maintained of the same dimensions as those adopted by the association, and we are glad to see the position we took so ably advocated by one of the ablest railroad men in the country. Mr. Rhodes wishes to have it made somebody's business to see that standards are what they are reputed to be, and to help in urging their general adoption. As a means of rendering standards of increased service to railroad companies he advocated the making of it legal for any railroad company to repair the cars of another company by using M. C. B. standards. This was a highly important change in established practice, but it was advocated so logically and eloquently that the association agreed without a dissenting vote to adopt the practice, and a rule establishing iis legality was inserted in the code.

We believe that the new rule will not only exert a very desirable effect in leading railroad companies to adopt M. C. B. standards, but that it will materially facilitate the movement of cars and save expense in the transporting of the material to be used in repairing cars. The draft gear of a car are the parts most liable to get damaged. As the principal parts of this portion of the car are standards, a foreign car can be repaired at once with the standards of the association, and if the company running the car does not use the M. C. B. standards the parts can be removed when the car returns home and used to repair foreign cars. This will greatly simplify the quantity of stock that has to be carried to repair foreign cars, and it will make companies not using standards more familiar with the merits of the designs that the M. C. B. Association has agreed upon as being worthy of adoption by all railroad companies.

Courtesies to those Attending the Conventions.

Railroad men attending the railroad mechanical conventions were exceptionally well treated by the various railroad companies in the matter of transportation. The Baltimore & Ohio not only gave passes freely from all points on the system, but arranged for and ran a special train of Pullman sleepers from Chicago to Baltimore. Mr. E. W. Grieves, Master Car Builder of the Baltimore & Ohio, made a special trip to Chicago for the purpose of accompanying this train, and attending to the comfort of those who were traveling by it.

The Richmond & Danville Railroad Company, over whose lines many of the visitors to the convention had to travel, issued a card pass for the members and their wives, good for the month of June, and Mr. R. D. Wade, superintendent of motive power, devoted a great deal of time and personal attention to promoting the comfort of visitors.

The convention was held at the eastern terminus of the Chesapeake & Ohio system of railroads, and the officers of that company were tireless in their efforts to show kindness to the visitors. In his address of welcome to the Master Mechanics' Association, Mr. Ingalls, president of the Baltimore & Ohio, said: "As far as the Chesapeake & Ohio is concerned, I am authorized to say that its doors swing wide open in hospitality to you, and whatever you want, from the salt sea waves at this end to the waters of the Ohio at Cincinnati, you can have." A similar spirit of hearty friendliness was displayed by all Mr. Ingalls' subordinate officers in dealing with the people attending the convention. The efforts of Mr. William Garstang, superintendent of motive power, in ministering to the comforts of the people attending both conventions were worthy of the highest praise. For two weeks he appeared to have relinquished all other work and devoted himself to laboring to make the conventions successful, so far as making the people comfortable could do so. The interests of "Southern hospitality" were well cared for by the railroad companies leading to Old Point Comfort.

Boiler Compounds.

At the various meetings of railroad men where the subject of the purification of feed water was under consideration of late months, there has been a decided tendency displayed to discredit the value of any compound offered for neutralizing the pernicious effects that feed water impurities usually produce on locomotive boilers. There are few lines of business run by practical men where more worthless nostrums have been tried than in the doctoring of feed water, with the result that there is now a strong inclination among those interested to regard all chemical remedies for bad water as productions of fraudulent quackery. There is good ground for believing that this wholesale way of disposing of all remedial agencies not only inflicts injustice upon those offering really meritorious compounds, but it prevents railroad companies from receiving the benefit conferred by mixtures that neutralize to some extent the injurious action that bad feed water exerts upon heating surfaces.

It does not always follow that things which have been successfully applied to stationary boilers will work satisfactorily with locomotives, but when a feed-water medicine acts in a stationary boiler to prevent the formation of scale the chances are that similar treatment would do good service with locomotive boilers if modified to suit the changed conditions. Papers have repeatedly been submitted to the American Society of Mechanical Engineers, describing the beneficial effects that resulted from the use of kerosene in steam boilers, and there is no room for doubting that the oil named is a valuable preventive of incrustation. At last meeting of the society Mr. R. C. Carpenter described experience with kerosene on boilers at Lansing, Mich. Badly scaled boilers were relieved of the incrustation through the use of kerosene, and then a small quantity administered regularly prevented the formation of new scale and caused the lime salts deposited by the feed water to remain in the shape of mud, which was readily blown out. There was about 20 grains of solid matter in each gallon of the feed water.

Kerosene may not be the petroleum compound best adapted for use in locomotive boilers, but the experience with it indicates that with a little care some such ingredient might be used in locomotive boilers in a way that would materially reduce the expense for boiler repairs. We have heard the objection raised to the use of petroleum compounds that they released the scale in large pieces, which choked up the openings between the flues and the water legs. If the oil has this effect on an incrusted boiler it ought to be used with success in keeping boilers newly out of the shop free from scale. Prevention is always better than cure, and what is badly wanted on many railroads is a disposition to persevere in treatment that will make cure unnecessary.

During the discussion in the Master Car Builders' Convention of the appointment of a committee to confer with one from the Master Mechanics' Association about the two conventions meeting at the same place, Mr. W. H. Day made a very eloquent appeal in favor of a movement to establish permanent headquarters for the association. Mr. Day is a most impressive speaker, and the plan he proposed was highly alluring. We were surprised that his motion to appoint a committee to investigate the practicability of establishing permanent headquarters was not agreed to. Mr. Day's plan has a great deal that is worthy of support, and we believe that very little agitation would bring round the members to acknowledge the wisdom of making for the association a central home where meetings could be held and evidences of the work performed by the association collected.

In his address before the Railway Master Mechanics' Convention Mr. Ingalls said: "It cannot but be of benefit to you and to the railroads that you meet together and dircuss matters of interest regarding railroad mechanics. Another reason in favor of such meetings, and equally good, is the fact that it gives you a few days rest from hard work, enables you to see something outside the shop, and to get a few bright moments in life where pleasure and not work is the rule of the hour." Mr. Ingalls evidently believes that all work and no play makes Jack a dull boy. He talked decidedly against the members sitting in the conventions for five hours without intervals.

The master car builder of an important railroad system has sent us a very interesting criticism of the article we published last month by "Progressionist" on the strengthening of the ends of passenger cars to better resist the effects of collision. Both of our correspondents are practical car builders with extended experience in car construction, and the points made by both of them throws new light upon the subject. Information of this character on car construction will be found highly acceptable, for it gives hints to car builders that will be used to strengthen passenger cars, making the effects of accidents less disastrous to travelers,

Personal.

Mr. John H. Murphy has resigned the position as master mechanic of the Erie.

Mr. G. W. West, of the New York, Ontario & Western, has been very sick, but he is getting round again.

Mr. F. Stamelen, who was for years general foreman of the Erie & Huron Railway shops, at Chatham, Ont., has taken the place of Master Mechanic vacated by Mr. G. R. Joughins.

Numerous expressions of regret were heard at the conventions owing to the absence of Mr. J. N. Lauder. That very industrious and useful member was seriously missed at the Master Mechanics' meeting.

Mr. William H. Owens, who was for some years foreman of the Richmond & Danville shops at Manchester, Va., has been appointed master mechanic of the Georgia Pacific, with headquarters at Birmingham. Mr. Owens is a very able mechanic, and was an excellent foreman.

The promotion of Mr. F. L. Sheppard, superintendent of motive power of the Pennsylvania, at Altoona, to the position of general superintendent of the road puts another very able mechanical engineer into the operating department of a company noted for pushing men of ability to the front.

Mr. Frank H. Andrews, proprietor of the Globe Iron and Spring Works, died of pneumonia on June 21, after a week's illness. Mr. Andrews has been largely interested in the manufacture of supplies for railroad companies, and at the time of his death was secretary and treasurer of the Baker Heater Company.

Mr. E. D. Nelson, of the Nortern Central was one of the new members of the last Master Car Builders' Convention, but he conducted himself as if it was not the first meeting at which he made his views public. He is clear and forcible speaker. The Pennsylvania is fortunate in its representative to the M. C. B. conventions.

Mr. James McNaughton, for some time master mechanic of the Northern Pacific at Livingston, has been appointed superintendent of the Wisconsin Central. Mr. McNaughton was for several years general foreman of the Brainerd shops of the Northern Pacific, and made a most enviable record there for the labor-saving methods he introduced.

A large circle of friends will be pleased to learn that Mr. John Ortten has been appointed superintendent of motive power and rolling stock of the Toledo, St. Louis & Kansas City. Mr. Ortten is a particularly capable master mechanic, and he has few equals in the practice and theory of mechanical engineering. The railroad company that has ecured his services will find Mr. Ortten a very valuabls officer.

Mr. A. Twohey, Superintendent of the Upper Coos and Hereford roads, was killed last month by the falling of a trestle bridge under the weight of a special engine, which was proceeding to a landslide on the Upper Coos road, about 20 miles from North Stratford, N. H. Mr. Twohey had been Superintendent of these roads since their construction, and was formerly connected with the Grand Trunk for a number of years.

In Zerah Colburn's valuable treatise on locomotive engineering, the author frequently refers to the practice followed by George S. Griggs, of the Boston & Providence railroad, and evidently holds that Mr. Griggs was a good reliable authority on American locomotive matters. That Mr. Griggs was the father of Mr. Albert Griggs, vice-president of the Railway Master Mechanics' Association and superintendent of motive power of the New York & New England.

The last convention was the first meeting of the Master Mechanics' Association that had been attended by Mr. Pulaski Leeds, although he has been a member for seven or eight years. No new member ever made a better impression. He did not speak often, but his remarks were to the point, and always conveyed new light upon the subject under consideration. Mr. Leeds is a particularly able mechanical engineer. It has been well known among railroad men that he had few equals as a mechanic; his talks at the convention and his letter on compound locomotives indicated that he is equally at home in the difficult field of steam engineering.

During the off hours at the conventions, when members sought for cool spots in the shade to swap stories, Mr. James Meehan—who, by the way, is a most interesting story teller and has had a particularly varied experience to draw from—told a curious incident of his experience. After the war he went to Cuba and went to work in a machine shop, where he soon rose to be foreman. Among the workmen was a Scotchman who was a very good mechanic, and to whom Meehan felt drawn in a remarkably kindly way. The man was advanced to be gang boss through Meehan's good offices, and he proved highly capable. They had been months in the shop, having more or less friendly intercourse. One day the man got badly injured, and Meehan went to his lodgings to perform the part of the Good Samaritan. In a conversation that followed they found out that they were cousins.

Considerable interest was manifested by the members of the Railway Master Mechanics' Association and others in how it came that Mr. George Royal, agent for the Nathan Manufacturing Co., who invoked the divine blessing at the opening of the convention, came by right to have the title "Reverend" attached to his name. It came about in this way. Early in the seventies Mr. Royal was appointed master mechanic of the Central Pacific, with headquarters in a wild mining region of Nevada. There was neither school nor church in the place, and Mr. Royal organized a Sunday school for the benefit of his own and other children. In connection with this work he was in the habit of delivering religious addresses to older persons, and he came to exert a powerful influence for good among the wild miners, and scarcely less hard railroad men of the district. The Baptist Conference, learning about the valuable work Mr. Royal was doing, ordained him a minister, and he still holds the license.

Removal of Balanced Valves.

It has been found necessary, on some roads where there are long and heavy grades, to remove the balanced valves from the engines and replace them with those of the ordinary type. The difficulty in their use arises from the fact that when steam is shut off and the lever dropped into the corner, the pistons draw in so much air through the relief valve and force it out through the exhaust, that the fire is kept burning as brightly as though the engine were steaming. This effect may be obviated by hooking the links back toward the center notch, but then the objection arises that the seat is worn hollow and soon becomes leaky. It is a choice between two evils; worn seats or a continual waste of steam from the safety-valves, and some master mechanics have preferred to escape both by removing the valves. This, of course, only applies on roads where there are long and heavy grades, and where the relief valve cannot be permantly closed.

Aboriginal Carpentry.

In speaking of ancient American tools, Mr. H. F. McLeod, of the Smithsonian Institute at Washington, recently said: "Aboriginal carpentry was the chief trade of our predecessors on this continent. The Indians and the mound builders had a very good idea of wood-working. You will see even now some very pretty joining done by Sioux Indians. Their tent poles make a fit which many a white carpenter would not like to try to better.

"The best carpenters, of course, were the Aztecs, who had arrived at quite a high stage of art, and whose tools, although they knew nothing of steel, are really excellent. We have a few of their tools at the Smithsonian, but the best collection is, of course, in the City of Mexico. The material used was almost wholly glass, especially for the finer parts of their wood-cutting. To chop trees they used flint axes, and for the rough hewing out of logs the same, but when it came to the accurate fitting in of the hewn timber, they handled glass knives, chisels and saws very deftly and with beautiful results. There is a ceaba wood post in Washington with hieroglypics and faces cut upon it all with glass. You can see bits of the original chisel still sticking in a corner of the wood, where it broke off three centuries ago under the hand of the workman. The Aztecs knew how to make a very good and manageable glass, and their best cutting blades, swords, daggers and spears, saws, chisels and axes, were made of it. When the edge dulled they broke it from the end instead of sharpening it, and got a new cutting line.

"You can see a great deal of aboriginal carpentry still in use among the Moqui Indians of the United States. Of course they use our tools now, but they follow their old patterns. They know how to make ladders, and they swing their doors on hinges from the top, and they know how to mortise timbers—knew how long before Columbus landed in America. Of course they use our tools differently from our way. The chisel they push rather than hammer, and they work the board up and down on a fixed saw rather than the saw on the board, but withal the get creditable results. The frame work in the Pueblos is quite as honest as anything we have in America."

Imperceptible Slip of Driving Wheels.

Some years ago a French scientist alleged that he had discovered that the driving wheels of locomotives slip imperceptibly while the engine is at work. Long articles were published in scientific papers relating to the subject, and the author was so positive as to the correctness of his so-called discovery that many engineers believed him. Engineers in different countries have made experiments to ascertain the correctness of the imperceptible-slip theory, but we have never heard of anyone finding anything that would support the position taken by the French savant.

Mr. F. W. Sargent, engineer of tests of the Chicago, Burlington & Quincy, lately sent to the *Engineering News* evidence that the alleged imperceptible slip does not occur. He rigged a circuit breaker on the guide of a locomotive, making it register every revolution on the paper in the dynamometer car. This was used for several hundred miles on different kinds of engines in all kinds of service, and there was not the slightest indication of imperceptible slip.

Railway Accident Statistics.

The following was submitted to the National Convention of Railroad Commissioners by Mr. Moseley, Secretary of the Interstate Commerce Commission.

The figures given below make an exhibit of the number killed and injured under the three heads, "Employés," "Passengers" and "Other Persons." They further show the classes of accidents, and the loss of life and injury to persons resulting from each. A summary of these facts is given in the table which follows:

RAILWAY ACCIDENTS
FOR THE YEAR ENDING JUNE 30, 1889.

KIND OF ACCIDENT.	Employés.		Passengers.		Other persons.		Total.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Coupling and uncoupling cars	300	6,757	....	....	....	....	300	6,757
Falling from trains and engines	493	2,011	....	....	....	....	493	2,011
Overhead obstructions	65	296	....	....	....	....	65	296
Collisions	167	820	107	445	37	48	311	1,313
Derailments	125	655	28	389	29	69	182	1,113
Other train accidents	189	1,016	26	247	522	515	737	1,778
At highway crossings	24	45	3	16	410	634	437	695
At stations	70	699	26	295	328	472	424	1,466
Other causes	539	7,729	120	754	2,215	2,874	2,397	10,880
Total	1,972	20,028	310	2,146	3,541	4,135	5,823	26,309

The railways of the United States carried 472,171,343 passengers during the year covered by this statement, from which it appears that one passenger in every 1,523,133 was killed, and one passenger in every 220,024 was injured. For the year 1888, the rate of casualty in England to passengers from railway accidents was one passenger in 6,942,336 killed, and one passenger in 527,577 injured. In judging of the above figures, it should be noted that passenger mileage for a given number of tickets sold is much greater in the United States than in England, a fact which mitigates somewhat the severity of judgment upon railway management in the United States disclosed in the above comparison.

In order to appreciate the above exhibit of casualties to employés of railways, it is necessary to know the number of employés liable to the various sorts of accidents recorded. The total number of railway employés in the United States is 704,736, which for the present purpose may be divided into Trainmen; Switchmen, Flagmen, and Watchmen; and Other Employés. The number of employés in each class, as also the casualties to each class' is given in the following statement:

CASUALTIES TO EMPLOYÈS.
ASSIGNED TO CLASSES NAMED.

Class of Employés.	Number	Killed.	Injured.
Trainmen	137,334	1,179	11,301
Switchmen, Flagmen, and Watchmen.	33,344	229	2,155
Other Employés	517,820	536	6,360
Unclassified	16,238	28	214
Total	704,736	1,972	20,030

The above facts are presented without comment respecting their significance, or respecting their bearing upon the general question of legislation providing for greater safety in the operation of railways in the United States.

The mechanical department of the Chicago, Burlington & Quincy have been engaged for some time in investigating the counterbalancing of the locomotives belonging to the company. The different master mechanics were instructed to investigate the arrangement of counterbalance weights that produced the most satisfactory results in service and a great amount of valuable information was collected. The results of the records of combined experience is, that a a rule has been adopted to balance all revolving weights and two-thirds of the reciprocating parts, balance for the reciprocating parts being divided equally among all the driving wheels.

Another way of imitating by machinery the product of laborious handwork is to be introduced into wood-carving. Of course ordinary moulding and stamped work and the papier-mache and pressed sawdust embossed work have been on the market for a long time, and but few people mistake them now for hand work. A new process, however, is said to have most deceptive results, but they can only be successfully produced upon soft woods. Basswood, for instance, can be compressed to a very large extent and will swell out again to its original proportions upon being steamed. This property is utilized in the following manner. A piece of the wood is subjected to great pressure under a die or stamp. This stamp presses down parts of the soft wood, in a more or less elaborate pattern, lower than the rest of the surface. This process can be quickly preformed and the piece of wood is then passed to a planing machine, which planes down the surface of the wood just even with the top of the compressed pattern. The piece is then taken over to the steamer, where the warm, damp vapor soon swells the compressed parts back to their original size. Thus a handsome raised pattern is produced on the planed surface of the wood.

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Eleventh Paper.

COMPARATIVE SUMMARY.—Having discussed the theoretical principles of the several forms of the compound engine which are applicable to locomotives, and having called attention in detail to the numerous conditions which control the application of these principles, we will now present a summarized statement of the factors which require special care in the design of compound locomotives, and will call attention to some minor points which have not been touched upon in the preceding papers.

It has been shown that the first requisite in attempting the design of a compound locomotive is detailed information concerning the work which is to be demanded of the engine. This is necessary in the first place, because the chief object in introducing compound locomotives is economy, which can be secured in any engineering work only with full and accurate knowledge of the subject in hand, and in the second place, because, as we have seen, the compound engine is not as flexible as the simple engine, although it is sufficiently elastic to be successfully used for any class of railroad work when originally intended for that service.

In the selection of a type of engine there will generally be considerable opportunity for individual preference. The two-cylinder type is unquestionably the simplest, but the large dimensions of the low-pressure cylinder, for a ocomotive, may make the adoption of one of the other forms desirable. If the two-cylinder type is chosen, there is still room for individual opinion in the selection of a form of starting gear and in the determination of the size of cylinders, which will depend to a certain extent upon the nature of the starting mechanism. Assuming that the maximum cylinder power as a compound is to be fully equal to the adhesion under the most advantageous circumstances, the conditions are about as follows: With a starting gear consisting of simply a valve and connections for admitting steam at reduced pressure to the receiver, the locomotive in effect starts as a compound, and the cylinders must be proportioned on that basis. But on the other hand, the cylinders must not be made so large that it will be necessary to cut off very early, or to reduce the initial pressure much by throttling, in those cases in which the total pressure required on the pistons is comparatively small, as, for example, when simply maintaining speed on a level track. The final pressure in the low-pressure cylinder must not be permitted to fall below the atmospheric pressure, and the engine should be proportioned to do the greater part of its work, according to Mr. von Borries, at from 0.3 to 0.4 cut-off in the high-pressure cylinder.

If an automatic intercepting valve is used, the effective pressure per square inch of piston may be increased in starting, but the locomotive will begin to work as a compound after from one-half to one and one-half revolutions of the driving wheels, depending upon the positions of the pistons, and the form and proportions of the intercepting valve, starting valves, and passages. The cylinders must be proportioned to do the maximum work which may be required after compound working begins. If the original Mallett system is adopted, the locomotive can be worked as a simple engine as long as desirable, and the cylinders may be made somewhat smaller than with the other starting devices. This system appears to be specially applicable to converted engines, as one cylinder may be retained for the high-pressure cylinder without necessary increase in boiler pressure.

In two-cylinder engines the total work can be very nearly equally divided between the cylinders by arranging the valve gear so that the cut-off in the high-pressure cylinder is somewhat earlier than that in the low-pressure. The turning moment on the driving axle will be more nearly constant in a well-proportioned two-cylinder compound than in a simple locomotive, because for the same mean effective pressure the cut-off in each cylinder of the compound will be later than in the simple engine. This possible advantage may be lost by improper valve adjustments which permit excessive compression and a very unequal division of work between the cylinders.

To avoid excessive compression, particularly in the high-pressure cylinder, with the ordinary link motion, inside valve clearance, considerable lead, and large cylinder clearance may be necessary. The question of the proper amount of compression in order to secure the most economical results is one which need not be discussed in this connection, as the problem which confronts the designer of compound locomotives is how to prevent the pressure at the end of the compression from exceeding the initial pressure.

The tandem form of four-cylinder compound locomotive would seem to be next to the two-cylinder type in simplicity. The number of pistons is doubled but the steam distribution on each side of the engine may be controlled by one valve, and there is no increase in the number of connecting-rods, eccentrics, etc. The additional complication is almost entirely in the valves, ports, and cylinders, and not in the driving connections, so that while the first cost will be greater, there is little reason to anticipate much increased cost for repairs. In the design of tandem engines the factors which demand special attention are the probable increase in the weight of cylinders, the compression in the high-pressure cylinder, the drop in pressure between the cylinders, the increased weight of reciprocating parts, and the protection of the cylinders from loss by radiation. The last item is specially important in this class of engines as there is no opportunity of drying out the steam between the cylinders. The division of work between the cylinders is comparatively unimportant. The great advantage of this arrangement of cylinders lies in the opportunity which it affords for the realization of great power together with economy without the employment of exceedingly large cylinders and with but two sets of rods, links, eccentrics, etc. The problem of starting power offers no difficulties in this type of engine.

The three and four cylinder compound locomotives with receivers have many points in common with the two-cylinder form. The sole advantage of the Webb engine appears to be the absence of coupling rods. The three-cylinder type, having one high-pressure cylinder and two low-pressure cylinders, together with the four-cylinder receiver engines, have the advantage of a very uniform turning moment and an excellent balance, with the disadvantage, common to all these forms, of much complication and consequent increased first cost and expense of maintenance.

PISTON SPEED—WEIGHT OF RECIPROCATING PARTS.—It has been urged by opponents of compound locomotives that, while there are admitted advantages in compound working with the "slow piston speeds" found in marine and stationary engines, the high piston speeds found in locomotives make compounding a doubtful experiment. As a matter of fact, there are large triple expansion marine engines running at piston speeds of over 800 feet per minute. The piston speed attained by the quadruple expansion engines of the torpedo boat "Cushing" was 925 feet per minute on her trial, and the speed of pistons of the triple expansion engines of a recent Turkish torpedo boat is given as 936 feet per minute on a trial trip. If these speeds are practicable with triple and quadruple expansion engines, there does not appear to be any good reason for doubting the practicability of speeds of 1,100, or even 1,400 feet, with compound engines. There is undoubtedly a maximum limit to piston speed, and it is lower for compound engines than for simple engines using the same boiler pressure. But the limit is sufficiently high to be comparatively unimportant to the designer of locomotives. The cause which limits the speed is the weight of the reciprocating parts. In an engine working at a speed of 250 revolutions per minute, the reciprocating parts must be started from a state of rest at the beginning of each stroke, and their speed accelerated to about 26 feet per second during approximately a half stroke, which occupies about 0.06 second. The method of calculating the necessary steam pressure per square inch of piston to produce this acceleration need not be explained in these pages, as it does not relate distinctly to compound locomotives. A very full and complete discussion will be found in a paper by Mr. D. S. Jacobus, in Vol. XI. of the Transactions of the American Society of Mechanical Engineers. Taking Mr. Jacobus' figures, the pressure per square inch of piston for a locomotive having a cylinder 18½ inches in diameter and 24 inches stroke, required to overcome the inertia of the reciprocating parts and accelerate them at 250 revolutions per minute, varies from about 55 pounds at 10 degrees from the dead point to 0 at about 80 degrees. The work stored in the reciprocating parts during the first half of the stroke is of course transmitted to the crank-pin during the last half of the stroke, but the effective pressure on the crank-pin during the first half stroke is only that due to the difference between the apparent pressure as shown by the indicator card and that necessary to accelerate the reciprocating parts. It is evident that if the pressure of the steam on the piston is just equal to that required for acceleration at any position of the piston, no pressure will be transmitted to the crank-pin at that point in the stroke, and that if these pressures are equal during the period of acceleration, all pressure which is transmitted to the crank-pin during the stroke will be during the second half stroke. The maximum piston speed of the engine will then be practically not far from that at which this occurs.

The pressure necessary to produce acceleration varies directly as the weight of the reciprocating parts, and as the square of the speed of rotation. The possible means of reducing this pressure are therefore to make the reciprocating parts lighter, or the driving wheels of greater diameter. How much the distribution of pressures on the crank pins will be affected by such changes is a question which must be solved by the designer in each case, and it is a factor which is worth careful consideration, more on account of the crank pin pressures than on account of the limitations of speed. A considerable reduction in weight is effected by the use of steel wherever practicable for the reciprocating parts, and the adoption of the most economical shapes for connecting and coupling rods. In this connection the illustrations of recent two-cylinder compound locomotives in *Engineering* for Feb. 1, 1889, June 21, 1889, and Feb. 7, 1890, are worthy of careful consideration.

ECONOMY.—The principal reasons why a compound locomotive should be more economical than a simple locomotive may be briefly summarized as follows: More economical use of steam by greater expansion; reduced loss from cylinder condensation; better steam distribution on account of later cut-offs, and decreased demand upon the boiler. The commercial economy of the locomotive is the combined result of these causes and also frequently includes a gain by reason of the increased boiler pressure. It is probable that we may add to the above reduced cost of repairs on account of less rapid depreciation of the boiler and more uniform strains on pins and axles. The gain by greater expansion and less loss by cylinder condensation is common to all multiple-cylinder engines, and the reader is referred to works on the theory of the steam engine for detailed discussion of these subjects. Among the many books which are valuable may be mentioned, in addition to those previously referred to in these pages, "The Steam Engine," by Prof. W. D. Marks, and "The Steam Engine," by Prof. J. H. Cotterill.

TESTS IN RUSSIA.—Since the table of reports of comparative tests of two-cylinder compound locomotives given in the Sixth Paper was prepared, Mr. Thomas Urquhart, Locomotive Superintendent of the Grazi & Tsaritsin Railway, in Southeast Russia, has made public the results of his tests of compound locomotives in a paper read before the Institution of Mechanical Engineers, England which was published in full in *Engineering* of Feb. 21 and March 7, 1890.

This paper is particularly interesting, as all of the engines tried were converted from simple engines, without increase of boiler pressure. The following is a brief abstract:

An experimental converted engine was put to work in September, 1887, and on trials against a simple locomotive did the same work with a consumption of 22 per cent. less of petroleum refuse. This result was so satisfactory that other locomotives were converted, and in December, 1889, there were in daily use twelve six-coupled freight engines and three four-coupled passenger engines. It is intended to convert the remainder of the locomotives on the line to compounds as fast as the shop facilities will permit. The mean consumption of petroleum refuse per engine mile for freight engines for ten months of 1889 is given in a table as 30.65 pounds for simple locomotives and 25.4 pounds for the compound locomotives. The mean saving in fuel is therefore 17.1 per cent. From April to August, inclusive, the saving by five compound freight engines ranged from 14.75 to 25.57 per cent., the average being 18.96 per cent. A compound passenger engine saved in the same period 18.22 per cent. Mr. Urquhart's conclusion is that 18.5 per cent. may be safely taken as the saving by compound compared with ordinary locomotives. In converting these locomotives one of the original cylinders was retained for the high-pressure cylinder, and the former boiler-pressure of 135 pounds was also retained.

The dimensions of some of these locomotives are as follows: Cylinders, 18½ inches and 25⅝ inches in diameter by 24 inches stroke; six coupled driving wheels, 51 inches in diameter; adhesion weight, 36 tons; tubes, 151, outside diameter, 2¼ inches; length between tube plates, 13 feet 10⅛ inches; heating surface, total, 1,231 square feet; grate area prior to using petroleum, 17 square feet; Stephenson link motion; maximum travel of valves, 4¾ inches; angular advance of eccentrics, 20 degrees; high-pressure valve, outside lap, 0.81 inch; inside clearance, 0.08 inch; low-pressure valve, outside lap, 0.67 inch; inside clearance, 0.0. The author found that a very small difference in lap, outside or inside, amounted to a great deal in fuel consumption. In more recent locomotives the low-pressure link hanger has been made ⅝ inch longer than the high-pressure hanger.

The starting gear adopted and illustrated is of the Mallet type, being wholly under the control of the engine runner. A cock is provided for admitting steam from the boiler to the receiver, and there is a separate exhaust from the high-pressure cylinder to the atmosphere, the exhaust pipe being placed outside of the smoke box on the high-pressure side. The opening into this pipe is controlled by a plain disk valve, operated from the cab. A flap valve prevents the steam in the receiver from escaping back through this pipe or to the high-pressure cylinder, and is connected so as to be worked by the same lever as the above-mentioned exhaust valve.

It was found by trials that these converted locomotives were capable of hauling as heavy trains as the simple locomotives. With the reverse lever in the same notch in both classes of engines, the power of the compound was found to be less than that of the simple engine, the difference increasing as the cut-off was made earlier, from 5 per cent. in full gear to 28 per cent. in the "first notch" in the freight engines. The volume of the receiver was made equal to that of the high-pressure cylinder in the earlier engines and in the later designs was increased to 1.3 and then to 1.8 times the volume of the high-pressure cylinder, with good results.

It may be well to note that there is nothing contradictory in these results of Mr. Urquhart's experiments to what has already been said concerning the power of two-cylinder locomotives. With the type of starting gear adopted, the engine cannot be deficient in starting power if originally well proportioned, and after starting there is no difficulty. The mean pressure with any given cut-off in the high-pressure cylinder is necessarily less than in the simple engine with the same cut-off and the same boiler pressure, since the expansion is greater in the compound.

Mention was made in a previous paper of the reported advantage found by Mr. Urquhart in arranging the cranks

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so that the low-pressure led in forward motion, and the writer stated that the reason for the improvement in the steam distribution which was claimed was not apparent. The tables in Mr. Urquhart's paper show that in the two engines which were compared—one with the low-pressure crank leading and the other with the high-pressure leading—one high-pressure cylinder was 18.5 inches in diameter while the other high-pressure cylinder was 18.11 inches in diameter, for the same notch in the quadrant the points of cut-off in the high-pressure cylinders were different, and in one engine the low-pressure cut-off was considerably later than the high-pressure, while in the other the distribution was very nearly the same in both cylinders. These points of difference are sufficient to vitiate the conclusions in regard to sequence of cranks. The only conclusion which is apparent after a study of crank diagrams is that the sequence of cranks is of very little consequence.

The following, from *Engineering*, referring to Mr. Urquhart's tests, is worth noting : "His experience is especially valuable as the steam pressure has not been increased in the converted engines, and thus there is no fear that it may be argued the economy claimed for the compounding has been partially, if not wholly, due to another cause, *i. e.*, the higher pressure. This is a line of argument with which marine engineers were very familiar at one time. Mr. Urquhart's experience is also valuable for another, and perhaps more, important reason. It is often claimed by those who do not believe in compounding locomotives that the economy in fuel stated to be made is due more to the firing than to the system. . . But Mr. Urquhart's locomotives are mechanically stoked—that is, they are worked with liquid fuel—so that the ordinary conditions of good or bad firing do not apply. Whether the 'human factor' crops up in other directions we do not know. . . The evidence in favor of the compound locomotive, as being economical in fuel, is now of a very complete nature, and the 'human factor' argument is the chief one left to those who oppose the system."

Early Railroading in England.

Mr. Joseph Tomlinson, President of the Institution of Mechanical Engineers, in his address brought out some very interesting points in relation to early locomotive practice in England. After describing many curiosities about early rolling stock, he continued:

"No passenger trains were run on Sundays, except between Darlington and Stockton once each way, which were worked by a horse. The carriage was on four wheels without springs, and was made to carry six inside and fourteen outside, including the coachman. It was an ordinary road stage coach with two front ends. The ordinary passenger trains on week days had one first class with three bodies, which could carry eighteen passengers, and one second class, also with three bodies, which could carry twenty-four passengers; these two were attached at Darlington to the train which came from Shildon, and were put off at Stockton. The engine coming from Shildon brought a composite carriage with one first-class and two second-class bodies, or twenty-two seats, which was run on to Middlesbrough. The speed, including stoppages, averaged, say, 16 miles per hour for the whole journey of twenty-four miles.

"One engine not already described, which was also put on the old line, was the first goods engine with a crank-shaft, a fire-box proper and a tubular boiler. It was built by Kitching, of Darlington, about 1838, and was called the Queen.' It had four wheels only, with cylinders below the level of the axles and inclined upward, 13 inches in diameter and 18-inch stroke, and outside frames. All the wheels were coupled, and were of wrought-iron. The engine was very similar to engines made about 1839 and 1840, and put on many other railways ; it was used for years, but with a small pair of wheels added behind. The Clarence Railway, which is now, like the Stockton and Darlington, a part of the present Northeastern, had mineral engines at starting very similar to those I have described. This line ran from Coxhoe to Port Clarence, with a branch to the old line, and was a rival to it; and hence any coal from Shildon to Simpasture, the junction, had to be worked by horses, as it had no running powers, and the Stockton and Darlington would not supply engines. Four wagons were drawn by one horse, and there was attached to the end what was called a dandy cart, into which the horse was trained to put himself when the loaded wagons would run by gravity. The first outside cylinder engine ever made with horizontal cylinders was put on this Clarence line, and was built by Hackworth & Downing on Shildon bank top. This Hackworth was a brother of Timothy, and afterward started with Mr. Fossick the works at Stockton, now known as Blair's. The engine had the usual return-flue type of boiler, with six wheels, coupled, and cylinders 13 or 14 inches in diameter, and of 20 or 22-inch stroke. Up to this time all the mineral engines were innocent of framing, as it is now understood ; all the parts for doing the work of drawing and carrying were attached to the boiler, and hence all were as light as could be made."

"All the engines up to and including the 'Swift,' which was built in 1836 or thereabouts, had only two eccentrics, which, of course, necessitated hand-working to start in either direction. This of itself required a practiced hand to do, and would bother nearly every engineman of to-day, inasmuch as, since the abolition of the old Bury engine of the London & Northwestern Railway, that plan has become obsolete. There was no brake of any kind on engine or tenders, as I have said. The only way of controlling the trains down the banks was to put the engine out of gear, or for the fireman to drop off the engine, and let down as many wagon brakes as he thought necessary ; and when they had to be taken off he had to repeat the operation of getting off and lifting them, he himself then getting on the last wagon of which the brake had been down and walking along the top of the coals back to his engine. In my early days the engines were worked by contract by the driver, who found coal, oil, and every requisite, and was paid by ton of coal moved. The driver had two men in his pay, one a driver-fireman and the other a fireman. The steam was got up on Sunday night by the fireman, and the driver and he ran the first train on Monday morning (as early as coal was there to take) from Shildon to Middlesbrough, the then port of shipment. On the return to Shildon in about eight or nine hours, the fireman went home, and the driver with his driver-fireman ran the second trip; and on the completion of the second trip the driver went home, and the driver-fireman took charge as driver, and the fireman who had been resting resumed duty as fireman, and this system was followed day after day. No trains were run on Sunday."

In the early days of railroading many crude practices were followed, the description of which would be amusing to modern railroad men, but we have heard of nothing more inconvenient than the practice of oiling cars followed on the Stockton & Darlington railway as described by Mr. Joseph Tomlinson. After going about a mile from Sheldon, the author says, all the wagons had to be oiled, as there were no grease boxes; the engine was slowed down on the level to about three or four miles an hour, and the two men got down, one on each side, with his oil can and a hazel stick about three feet long, at the end of which a piece of oakum was tied; and with this the underside of each journal running in a cast-iron plummer block was carefully oiled. After all were done, they got on the top of the last loaded wagon, and walked back to the engine, and away they went. This was repeated after about 12 miles, when going in both directions. There was no guard and no brake van, and so all depended on themselves. As there was no van, it was necessary in the daytime to put a board up on the last wagon, so as to be sure they had not lost any of the train At night a large pan of fire was affixed to the front of the tender, and to the last wagon, for the same purpose; and it was the duty of the fireman to keep both alight. There were no signals and no pointsmen, each man taking care of himself and his train, and keeping out of the way of the few passenger trains run.

Hints on Firing.

The following sensible directions about firing locomotives are given by Thomas Reese in an article contributed to the *Locomotive Fireman's Magazine.*

My object in writing is for the edification of young firemen just learning to fire a locomotive. My advice is to have a system in doing your work; keep a place for everything and everything in its place; be dependable and truthful—always keep your lamps and cans ready for use, and when you get on your engine to go on the road, see that there is none of your outfit missing; look at your tender to see that you have enough water, see that your ash pan is clean and the sand box well supplied with sand, and that you have your regular supply of stores; and before starting out look at your fire and see that it is spread all over the grates. Avoid using the poker when the engine is working, as there is nothing that will spoil your fire sooner. If you have a choice of shovels always choose a small one—No. 4; or a narrow, square mouth, one that widens at the back, I have found better still. The way I get up my fire when starting from a terminal point with fine coal, is to fire with four shovel fuls—one in each quarter of the fire box, and I do not half fill the shovel. By firing with a small shovel you are not liable to choke your fire. If the pointer goes back, put your shovel inside the door with point down; that will form a current of air under your shovel, so that you will be able to see your fire, whether it is banked, or if there are any holes in it. And this is where a small shovel is of special advantage; you can fill up the holes better. With a small shovel you can drop the proper quantity of coal into a hole, whereas, with a large one you are more liable to put the coal where you do not want it; then you will have to get the poker to help you out, which means dirt and clinkers in your fire box to prevent the air getting to the gases of the coal. There has been a good deal said about consuming smoke. By light firing and keeping the grates free and a clean ash pan, as much can be done to gain that point as anything I know. I have fired an engine with brick arch and baffle plate with flappers in fire door, I had orders to keep the flapper partly open all the time when the engine was working, so as not to burn the baffle plate. Now, my idea is that the flapper should be left open for a little while to burn the smoke, and then closed till the next fire is put in. I would like to draw your attention to the evil results of heavy and poker firing, as often practiced by a new man making his first trip. He wants to do his best, as a rule; he realizes that it is his duty to put coal in the firebox, and he does it as best he knows how. He may keep the pointer up, or he may not; if it goes back he will naturally think it is for the want of more coal, until he gets so much in that he will have to fire with the poker for awhile, which will produce clinkers and dirt in the firebox to prevent combustion or a proper mixture of common air with the gases f the coal. As an illustration, a coal oil lamp will burn without a chimney, and, if you notice, a black smoke will arise from it. By applying the chimney you form a current of air to mix with the gases of the coal oil to form combustion. Having holes in your fire will not only prevent the engine from steaming, but the cold air coming in contact with the flues will make them leak. I may say that I am used to a Standard Rhode Island, and Pittsburg soft coal.

Near Newport News, Va., there is a very large and high grain elevator belonging to the Chesapeake & Ohio Railroad Company. The letters C. & O. on the side of the building designate the owners. The elevator is a conspicuous mark and attracts the attention of those passing by water through Hampton Roads and the James River. While an excursion of railroad men was going up the river at the time of the convention, speculation arose as to the height of the letters on the elevator, and guesses were readily made. Nearly every one on board the boat got interested and the guesses varied from 8 to 35 feet, the majority of the opinions ranging about 16 feet. All were very much surprised to learn that the actual height was 45 feet and the hair lines are four feet wide. Few people are good at estimating the size of an object at a distance, but those guessing on the size of the C. & O. letters were particularly far off.

A bill has been introduced into Congress by Mr. Lind, of Minnesota, making all express companies engaged in interstate commerce amenable to the Interstate Commerce Act. It also provides that all such companies shall report yearly to the Commission in detail the amount of capital stock and bonds issued, the amount paid and the manner of payment for the same; dividends and interest paid; the surplus fund; the number, names and addresses of stockholders; the funded and floating debt and the interest paid thereon and other data concerning the operations of the companies. Legislation of this kind is very urgently needed. Except it be telegraph and gas companies, there are no corporations serving the public which have became so intolerant in their charges as express companies. Rates are not regulated according to ideas of fairness, but on considerations as to what the business will stand.

Making of Veneers.

For a long time manufacturers of veneers have been trying to secure a fancy grain from straight-grained wood. Of course, the more wavy and intricate the line of the grain is, the more valuable is the veneer. A method has at last been secured of producing fancy veneers from plain wood.

To understand the new process one must first know what the old one was. It was simple enough. A log seven feet long or less, and of almost any diameter above seven inches, had its bark chipped off and was then steamed overnight in a tank made for the purpose. In the morning it was ready to be fastened into the big lathe, and a knife blade as long as the longest log used—seven feet—was kept pressed against the wood so as to cut off a shaving or ribbon about one-thirtieth of an inch thick as the log revolved toward it. Two men rolled up the ribbon and carried it away as it was turned out. Of course, the knife had to be set parallel with the axis of the log or the wood would not all be cut up, and so, if the grain of the wood were straight, the ribbon could not have a variegated appearance, even had the long, straight knife cut the grain at an angle.

The inventor of the new process noticed that the growth of no two different years in a tree had exactly the same color and grain, even when the log was perfectly straight-grained. So if a knife were made that would strip off a ribbon that dipped in and out through the growth of, say, two years, the ribbon would have two kinds of grain. To get the ribbon the inventor made a knife with a wavy edge. The waves were a quarter of an inch high. However, this did not produce a sufficient variety in the grain of the ribbon to suit the inventor, and he added to it by giving the knife an oscillating movement in the direction of the length of the log by a cam of a half-inch stroke. Now, if the log revolved against the knife a ribbon was cut which contained waves that zigzagged up and down and exposed a grain not only variegated in color by the varying depths to which the knife had cut, but which was at the same time very wavy, if not curly, in appearance. The variegations in the color even of a plain black walnut log were remarkable and beautiful.

There was one objection to this remaining, and that was that it did not lie down flat on the surface to which it was glued, This was remedied, however, by stacking up the ribbon in a hydraulic press that squeezed it with a pressure of 40 tons to the square inch. It came out of that press flat,

At present three kinds of knives are used in these machines. There is no telling what new forms of knives will be invented. The machine itself is but little more expensive than the old style, but a knife costs several times as much. Besides, when a knife gets dull a man has to labor over it for a month with emery wheels to get it in order again.

Communications.

Strengthening the Ends of Passenger Cars.

Editor National Car and Locomotive Builder:

In an article in the June issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER, "Progressionist" presents some very good, though incomplete plans for strengthening the ends of passenger cars, to better resist the effects of a collision. He casually introduces the case of the rear end collision on the New York Central last September, in which the last car (an official car) sustained with slight damage the shock of the following train consisting of a heavy locomotive and six sleepers, while the car ahead (a private car), and the sleeper next to it were crushed for one-third of their length; after part of the momentum of the oncoming train had been absorbed by the official car behind them. This latter car was, in fact, found to be in condition to send home on its own trucks for repairs. The sides of the car were not damaged or sprung in the least degree as evidenced by the freedom with which all sashes could be raised and lowered. Neither did the blow have the effect of throwing any part of the frame out of square. A swinging door located in a partition 11 feet from the end of the car, which was struck, swung just as true and as freely as the day the car was turned out of the shop. Yet "Progressionist" intimates that the favorable comments of the press, at the time, on the construction of this car were undeserved; that the condition of these three cars after the wreck was mere chance; favorable conditions for the last car in the train and unfavorable for the other two. Can any of your readers imagine a more severe test to apply to such a construction than the impact of a wedge (the locomotive) passing between the side walls of a car, and driven by the momentum of the weight of a locomotive and heavy train at the rate of 40 miles per hour?

It seems improbable that "Progressionist" can be correct in his assertion that, "It is quite possible that the cars that were so badly damaged were just as well constructed." "Progressionist" then goes on to describe and illustrate his ideas of the best methods to construct a car, which, in the event of a collision, as above, would present the maximum resistance to telescoping or crushing.

His ideas are good as far as they go, and the official car under discussion embodied the best parts of them all, as illustrated in Figs. 3, 6, 7 and 8 of his communication. "But why is Progressionist" such a strong advocate of a construction similar to this official car if the results, as indicated above, depend on chance?

There is one point however in the construction of this official car, which "Progressionist" does not include in his recommendations. The end sill of the car bottom consisted of two parts with a ¾ × 8 inch iron plate placed between, thus

the whole being bolted securely together and to heavy iron angle plates at the corners where the side sills are framed to the end sills. The longitudinal sills were all framed into the inner piece, thus leaving the main end sill intact, the better to resist all strains.

This construction was placed on the telescoped sleeper and private car above mentioned, when repaired, and also on all sleepers since built, or rebuilt by owners of the sleeping cars in that wreck.

Now, if "Progressionist" will also adopt this detail in his construction as well as the other points he mentions, the chances will be increased an hundredfold for his cars to come out of a collision in as good condition as the car, the construction of which he ostensibly undervalues, but really admires.

CAR BUILDER.

Slipping of Driving-Wheels.

Editor National Car and Locomotive Builder:

I have read with considerable interest the communication of your correspondent "Motive Power" on the slipping of drivers when an engine is running down grade without using steam.

I am not going into any long argument on the subject, but simply to ask him one question. He says, "I rode upon engines for fifteen years, and upon all kinds," but does not add under all circumstances, hence the interrogatory. Did he ever ride on a locomotive, with a heavy freight train behind him, down an 80-foot grade for twelve miles, with the rails covered with sleet or frost, the speed of which could not be controlled by the brakes?

If he had he might not now be a "doubting Thomas."

I do not wish to convey the idea that it is a common occurrence for the drivers of a locomotive to slip running with the throttle closed. Indeed, I think there are not many engineers that have been placed in circumstances to discover that such is the case. It is an established fact that at a very high rate of speed and certain conditions of the rail the drivers of a locomotive will slip with the throttle closed. However well it may suit your correspondent to "expose shams," he will find that no amount of sarcasm will convince those that have witnessed it that they are mistaken.

E. W.

SPRINGFIELD, Mass., June 5, 1890.

Against the Detroit Plan of Joint Inspection.

Editor National Car and Locomotive Builder:

An article on the two systems of joint inspection, generally recognized and signed "Progressionist" in your May number, is rather misleading. In the first place, is the Detroit plan, as it is styled, joint inspection? I cannot see wherein it can be classed as such. Each company hire their own inspectors and control them through their foremen irrespective of their connections, except so far as jointly having a man to settle disputes arising in the delivery of cars to connecting lines. This joint man, having no responsibility whatever as to promptness or care in the inspection, is merely an arbitrator in disputed cases.

In the first place let us consider what are the chief objects to be looked after and which can be summed up in quick despatch, safety, and a proper discrimination of repairs between the delivering and receiving company. Taking time as the first question I do not think that it has been shown where joint inspectors have been dilatory in their work of examining all cars arriving in the yard irrespective of their being local or through. On fast or perishable freight, an extra effort is always made to inspect the cars with the least delay consistent with a proper inspection. The second question being safety, as the joint inspector is held responsible in this respect as much care and interest, I believe, is taken as if he were employed by a single company, and had but their interest at heart. The third question is a proper discrimination of repairs by the delivering company. The joint inspector has no one to get even with, and is actuated to do his duty to all, using his best judgment under all circumstances, and the more consistent are his decisions in following out instructions from time to time, the more liable he is of being retained in the company's service and for promotion.

Now, let us consider if there are any advantages over the Buffalo joint system. "Progressionist" says the other system is cheaper. I cannot see how that can be when he advocates inspecting the cars both before and after delivery, especially when the company delivers cars in one yard and receives from their connections in another, which would necessitate two sets of inspectors. Time enters largely into this question, so much so that traffic superintendents had to issue stringent orders to their yardmen not to couple their engine on cars being inspected until they were finished and flags removed from each end by day and lamps by night. If such precaution was found necessary to hold cars for one inspection, how will it be for the second? Using the inspectors for repairing when not engaged in inspecting would be somewhat of an experiment. A car inspector has a position of trust and responsibility, as carelessness on his part might cost thousands of dollars. If he is required to repair cars between trains, I do not think under certain circumstances he would be in a frame of mind specially adapted for a proper inspection of a train of cars, nor would he have a stimulus for an extra effort even though the case demanded it. As for "Progressionists'" figures in regard to the number of inspectors, that certainly depends on the number of roads interested and the number of cars to be inspected; but I will assure him they are down to a minimum. The salary of clerk is down at $60 per month, which should be $50, and as for stationery, $240, instead of being per month it should be for five years or longer.

J. C.

A Curious Traction Increaser.

Editor National Car and Locomotive Builder:

I enclose a sketch taken from a cut in the *Scientific American* in reference to the Swinnerton locomotive. Will you please say through the CAR BUILDER how the designer can get any more weight on the driving wheel by admitting air into the small cylinder and pressing down that lever. It looks to me like a man sitting in a boat and blowing at the sails with a bellows worked in the boat; he might sail along, but I don't believe he would; or a man sitting on a table with the air cylinder on his back and admitting air to press on a lever attached to the top of the table—(query) would the table be any heavier to lift? or, again, the old-fashioned conundrum of a fellow lifting himself by his boot straps. Seriously, though, I have tried to get at the principle, but failed, and thought you might take the trouble to look into it and give the necessary explanation.

J. H. BIRKETT,

Canadian Locomotive Works, Kingston, Ont.

[The invention referred to by our correspondent is an absurdity. No additional weight could be put on the driving wheels by the arrangement as it is illustrated by the journal mentioned in our correspondent's letter.—ED.]

Effect of Balanced Valves.

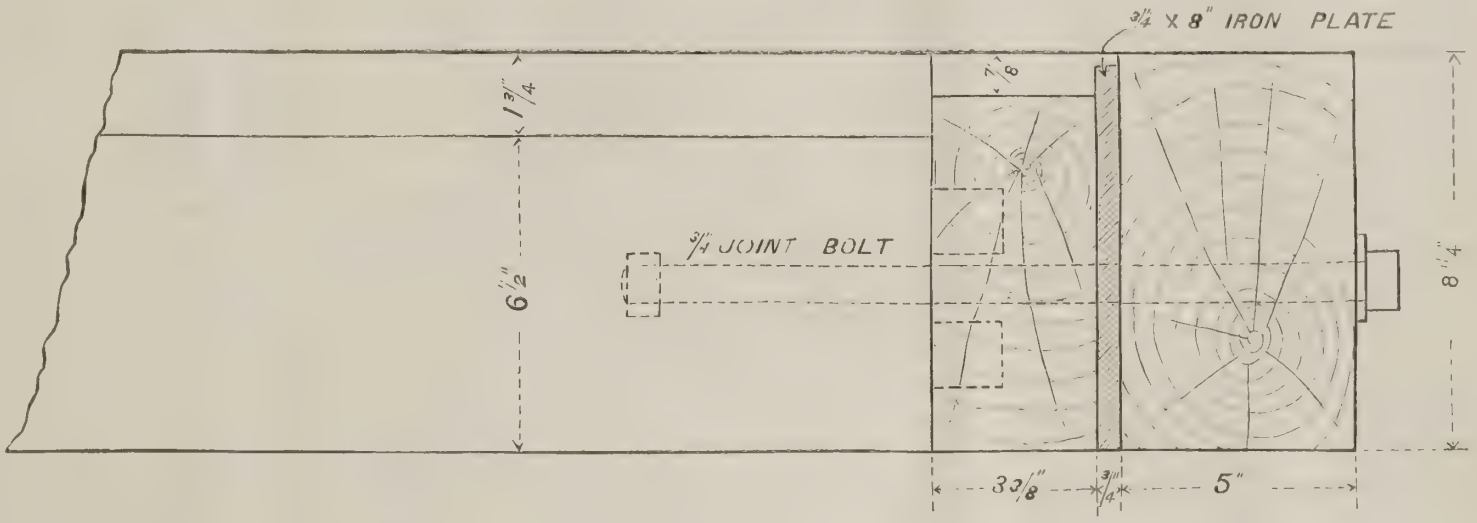
Editor National Car and Locomotive Builder:

What is your experience in applying balance valves to old engines? Have you taken diagrams before and after they were applied, and, if so, what were the results? There is some opposition to their adoption throughout the country by engineers, claiming that certain engines are not as good and quick as before the balanced valves were applied. Of course, the effect is easily discerned, but I am of the opinion that where the valve does not improve any engine that it is from a too small steam chest, thereby wiredrawing steam into cylinders, where there are ample steam chest and large relief valves to permit easy rolling. I cannot see why the balance valve is not a great improvement to the locomotives.

S. O. D.

MOBILE, May 16.

[Our correspondent expresses fairly well the views we hold about balanced valves applied to old engines. We have known of cases where the small steam chests used appeared to defeat the object sought in applying balanced valves, but that was no fault of the valves. We never had the opportunity of indicating an engine before and after balanced valves were applied. If any of our readers can give more information on this subject we should be glad to hear from them.—ED.]



SECTION THROUGH END TIMBER OF PASSENGER CAR.

Saving of Dead Weight by use of Steel.

While looking over the exhibits of steel plates for car construction at the Old Point Comfort Convention, we were struck with the saving in dead weight already accomplished by the use of steel center plates and stake pockets. At our request the Schoen Manufacturing Company prepared for us the following statement showing the approximate saving in dead weight and cost by the use of our pressed steel center plates and stake pockets on 4,000 cars, built by the Philadelphia & Reading Railroad.

Saving in dead weight per car, by using pressed steel center plates and Stake pockets..... 548 lbs.
Average mileage per annum per car..... .. 8,000 miles.

548 lbs. dead weight moved 8,000 miles, equals 2,192 tons moved one mile at $0.426 per ton mile, this equals $9.$\frac{327}{1000}$ per car per annum.

Assuming that to be the cost for moving paying freight one half of this would be the cost of non-paying load, as the weight of the car about equals the average load hauled, this would be $4.$\frac{663}{1000}$ per car per annum as the cost of moving the extra weight of cast iron centre plates and stake pockets.

On 4,000 cars it would amount to the total of $18,652 per annum.

Taking twelve years as the average life of these cars, this would make the total sum of $223,824 saved by substituting steel for cast iron.

List of the Exhibits at the Conventions of the Master Car Builders' and Master Mechanics' Conventions.

American Flush Car Door Company, Indianapolis. Wagner car door.
American Brake Company, St. Louis, Mo. Model of locomotive driver brake.
American Continuous Draw-bar Company, Aurora, Ind. Draft and buffing apparatus.
Anchor Iron Car Roofing Company, St. Louis, Mo.
Anthony and McElroy, Philadelphia. Samples of hexagonal turnbuckles manufactured by the Central Iron and Steel Company, of Brazil, Ind.
Automatic Interchangeable Car Coupling Co., San Francisco, Cal., train equipped with couplers (Fox patents).
M. A. Andrews & Co., Syracuse, N. Y. Car gear.
F. W. Bird & Son, East Walpole, Mass. Neponset waterproof insulating and roofing papers.
T. A. Bissell, superintendent Wagner Palace Car Company, Buffalo, N. Y. Blue print of a brake shoe hanger.
Boyden Air Brake Company, Baltimore, Md. Full train equipment of air brakes.
Boies Steel Wheel Company, Scranton, Pa. Full size car wheels.
Botsford Car Heating Co. Cleveland, O.
Buda Foundry and Manufacturing Company, Buda, Ill. Hand and push cars.
Butler Draw-bar Attachment Company, Chicago, Ill.
Capital Journal Bearing and Coupler Company, Columbus, Ohio.
Capital Manufacturing Company, Chicago, Ill. Adams bolt threading machines, Holland improved Acme wrench.
Carnegie, Phipps & Co., Pittsburgh, Pa. Throat-sheet for Belpaire fire-box; cold drift tests of fire-box steel; cold punching tests; boiler rivet; sample of staybolt iron.
Central Iron and Steel Company, Brazil, Ind. Turn Buckles.
Chalmers Spence Co., New York. Asbestos cement covering for locomotive boilers; fire-felt train-pipe covering; roll fire-felt and millboard.
Chapman Jack Company, Cleveland, O. Samples of the well-known Chapman jack.
Chase & Co., L. C., Boston, Mass. Fine Mohair car plushes. Samples showing comparisons with French plushes after three months' exposure to the sun.
Chicago Roller Bearing Truck.
Coburn Trolley Track Manufacturing Company, Worcester, Mass., full size working model of the Coburn car hanger and patent trolley track.
Congdon Brake Shoe Company, Chicago; the Ross-Meehan Brake Shoe Foundry Company, of Chattanooga, Tenn.; the Ramapo Wheel and Foundry Company, of Ramapo, N. Y., and the Ramapo Iron Works, of Hillburn, N. Y. Samples of brake shoes.
Cooke Railway Supply Company, Chicago. Sample of Cooke's wrecking frog and portable car replacer.
Consolidated Car Heating Company, Albany, N. Y.
Crosby Steam Gauge & Valve Co., Boston, Mass. Steam gauges, etc.
Disc drum system of car heating; commingler storage system; Sewall, McElroy, Peerless and Westinghouse Couplers, models in glass; Fire proof heater and water heater safety valve.
Damascus Bronze Co., Pittsburgh, Pa. Samples of the Damascus bronze for journal bearings.
Davis Spring Plate Co., Wilmington, Del. Spring Plates.
DeLong & French, Allegheny City, Pa. Specimens of hair felt for refrigerator cars.
De-Oxidized Bronze Co., Bridgeport, Conn., journal bearings and metals.
Detroit Lubricator Co., Detroit, Mich., lubricators.
Drake & Weirs, Cleveland, O., model of Winslow's patent asphalt car roof.
Dreher Manufacturing Co., New York. Lubricating compound.
Dunham Manufacturing Co. and National Hollow Brake Beam Co., Chicago, Ill. Hollow Brake Beams.
Elmore Box Lid Co., Chicago, Ill. Car Box Lid.
Erie Car Heating Co., Erie, Pa. Steam heating connection and automatic steam shut-off.
Eureka Nut Lock Manufacturing Co., Marshall, Texas. Specimens of nut locks for iron and woodwork.
Fairbanks & Co., New York. Steam specialties.
Fairbanks, Morse & Co., Chicago, Ill. Sheffield hand and push cars; steam hand car wheels; car box and O. K. jacks.
Field Water Purifier Company, Chicago, Ill. Mechanical feed-water purifier.
Fisher, Emil, Baltimore, Md. Renovated blankets, passenger car plush and curtains.
Flagg & Co., Stanley G., Philadelphia, Pa. Pipe fittings.
Fontaine Safety Signal Co., Detroit, Mich. Time signal.
Fowler Steel Car Wheel Company, Chicago, Ill. Solid rolled steel car wheels.
Fox Solid-Pressed Steel Company, Chicago, Ill. Locomotive boiler front.
Francisco, C. F., Santiago, Cal. Model of car coupler.
Frazer, A. Moore, Zanesville, O. Car coupler.
French, A., Spring Company, Pittsburgh, Pa. Elliptic driving spring with graduated band; steel oil box covers; Noble nut washer.
George R. Meneely & Sons, West Troy, N. Y. Journal bearings.
Goelet Automatic Car Coupler Company, New Orleans. Car coupler.
Gold Car Heating Company, New York. Car heating appliances.
Gould Coupler Company, Buffalo, N. Y. Car coupler.
Guernsay, W. W., New York. Car coupler.
Hartford Woven Wire Mattress Company, The, Hartford, Conn. Car seats and backs.
Hinson Car Coupler Company, Chicago. Ill. Car coupler.
Howe, Brown & Co., Pittsburgh, Pa., fire box steel.
C. P. Hutchin's Sons, Detroit. Model of car roof.
International Manufacturing Association, New York. Deck ventilating windows.
Johnston Electric Train Signal Company, Boston, Mass. Electric train signal.
Jewett Supply Company, Boston, Mass. Center and side bearings.
Jones Safety Spur Lock Company, Syracuse, N. Y. Nut locks.
Kalamazoo Railroad Velocipede and Car Company, Kalamazoo. Hand car; also the U. S. steel surface cattle guard.
Keegan & Halpin, New York, N. Y. The Wells light.
Knitted Mattress Company, Canton, Mass. Quilted textile fabrics.
Kling Automatic Car Coupler and Supply Company, Chicago, Ill. Car coupler.
Lone Star Automatic Coupler Co., of Rochester, N. Y., and Waco, Tex., full sized car coupler.
Marden Brake Beam Co., Boston, Mass. Brake beams.
Martin Anti-Fire Car Heater Company, Dunkirk, N. Y. Hose reel, automatic steam coupling, and DeKalb ventilating car window.
McConway & Torley Company, Pittsburgh, Pa. Car coupler.
McGuire Manufacturing Co., Chicago, Ill.
Morton Safety Car Heating Co., Baltimore, Md., car equipped with their heating system.
McEntee gravity car coupler, Montgomery, Minn.
Michigan Railway Supply Company, Detroit, Mich. Models of brake beams.
Milwaukee Car Wheel and Foundry Company, Milwaukee, Wis. Barr contracting chill wheel.
Mott, S. L. Patent extension running braid.
National Lock Washer Company, Newark, N. J. Nut locks.
National Car Heating Co., Topeka, Kan. Car equipped with their system of heating.
New York Car Wheel and Foundry Co., Buffalo, and Griffin Wheel and Foundry Company, Chicago, Ill. Bored, ground and balanced railroad and street-car wheels, automatic air brake register.
Nichol Lubricator Co., of New York. Samples of the Nichol gravity lubricator.
Peerless Rubber Manufacturing Company, New York. Steam and air-brake hose and Rainbow packing.
Ramapo Wheel and Foundry Co., Rampo, N. Y., and Ramapo Iron Works, Hillburn, N. Y. Car wheels and brake shoes.
Railway Lighting & Heating Co., Philadelphia, was represented by its agents, Coolbaugh, McMunn & Pomeroy, and exhibits the Frost dry carburetor system of car lighting. It has two cars of the Norfolk & Western equipped with this system, and gave an exhibition on several evenings.
Reeves, Paul S. Philadelphia, Pa. Car Bearings and Babbitt.
Richardson, F. W., Troy, N. Y.
Robert-Eastwick Car Coupler Co., New York. Car coupler.
Roberts Manufacturing Company, Columbus, O. Metallic steam pipe coupling.
Safety Car Heating and Lighting Co., New York. Engravings of lighting apparatus.
Schoen Manufacturing Co, Philadelphia, Pa.; Pittsburgh after August 1. Articles in pressed steel for car construction to replace castings.
Spang Steel and Iron Co., limited, Pittsburgh, Pa. Fire box steel.
Sprague Automatic Coupler Co., Sioux Falls, South Dakota. Prints of coupler.
Springer Automatic Car Coupler Co., Des Moines, Ia. Car coupler.
Smith Car Journal Oiler Co., Pittsburgh, Pa. Samples of Smith's patent oiler and oil box for locomotive and car journals.
Standard Paint Co., New York. Samples of building and insulating paper,
Steel Truss Car Wheel Co., St. Louis, Mo. Improved steel-tired wheel.
Standard Car Coupling Co., Troy, N. Y., set of M. C. B. automatic vertical plane couplers on the M. C. B. standard lines.
Tilden & Co., B. E. Car and locomotive replacing frog.
Townsend W. W. Jr., Minneapolis, Minn. Car coupler.
Transcontinental Car Lock & Seal Co., Chicago. Samples of the Davis car lock and seal.
Union Switch and Signal Co., Pittsburgh, Pa. Westinghouse buffer.
Van Dorston Cushioned Car Coupling Equipment Co., Philadelphia, Pa. Car coupling, also car equipped with coupler.
Vose & Cliff Manufacturing Co., New York. Yielding side-bearing.
Wands, J. C., St. Louis, Mo. Car door clamp lock, anchor iron car roof.
Western Valve Co., Chicago. Samples of valves, cocks, gates, etc.
William Waton, Chicago, Ill. Car replacer.
Watson & Kinney, Paterson, N. J. Car coupler.
William's Car Heating Co., Boston, Mass. Car heating apparatus.
Wood Extensible Air Car Step Co., Wilmington, Del. Extensible air car step.
Wilkinson, A. L., Richmond, Va. Sash holder.
W. S. Soule, Boston, Mass. Rawhide dust guards.
Zeigler car brake, Waverly, New York. Model.

Getting Out Railroad Ties.

The Pennsylvania Railroad and all its proprietary lines use nothing but first-class ties in the track, and nearly the whole supply now comes from West Virginia woodlands. The regulation dimensions for the ties gotten out for this company are seven inches face, seven inches thick and eight and a half feet long. This is the standard size for all first-class roads. A good, sound tie is expected to last eight years. All first-class standard gauge roads use hewed ties exclusively, while on most narrow gauge roads and on some small standard gauge lines sawed ties are accepted. The number of ties to a mile of track will average 2,500 when laid as approved by experience. In the past year the one company delivered on its various contracts between 800,000 and 1,000,000 ties. All ties before delivery are inspected and passed by an official appointed by the railroad company.

The cutting of the ties furnishes labor during a large portion of the year for the hardy sons of West Virginia, for it is from the forests of this State that all those ties which come up the river are obtained. They are cut and shaped in the woods, taken to the nearest stream of water and there left until a freshet comes to bear them to the river. Along the creeks which flow to the Ohio or its tributaries is heard the ring of the woodman's ax, which converts the young oak into material for paving the path. of commerce.

At the mouths of the streams are constructed booms, which check the ties and hold them for their owners. When all the ties have been caught the point of the boom is opened wide enough to allow them to float slowly through, and they are taken from the water to the barges as they leave the boom. Sometimes the point of the boom is placed up stream, in which case cables are extended from thence to the banks, and the ties are floated at one end for loading. These ties are branded with the owners mark when purchased. The sight at one of these booms during a spring freshet is worth going miles to view, the swollen stream being entirely covered with ties as far as the eye can see. Often by the breaking of the ropes of the booms thousands of dollars of loss is occasioned to the owners of the lumber.

The committee of the Master Car Builders' Association investigating the subject of "the best metal for brake shoes are carrying out experiments so scientifically that they are likely to add important information to what is known about friction.

Hussle—Pullman, of Chicago, had an order for a parlor car the other day to be done in forty-eight hours and he got it out. What do you think of that?

Flash---Friend o'mine in New York had ten minutes to make a train in yesterday, and he made it.

There was over three miles of seating furnished by the Frost Veneer Seating Company for the Monmouth Park Racing Association.

The Ashton Valve Company, of Boston, has just begun suit against the Coale Muffler and Safety Valve Company, of Baltimore, for infringement of patents. Damages are laid at $50,000. The trial will take place at Baltimore.

The Butler drawbar attachment is a very simple device and its great popularity is in no small measure due to its combination of strength with few parts, yet some improvements have been made on the attachment lately which will still further reduce the number of parts.

The Mt. Vernon Car Manufacturing Company, of Mt. Vernon, Ill., are getting well along with their new plant, and expect to get started about Aug. 1. They have closed a contract with the L. & N. R. R. Co. for 200 double hopper bottom cars on which to start their works.

The Ellis bumping-post made by the Mechanical Manufacturing Company, Chicago, is rapidly gaining popularity, especially with those owning private sidetracks. It is a very cheap and efficient device, and quickly saves more than it costs in the preventing of damage to cars.

The Davis Spring Plate Company, of Wilmington, Del., manufacturers of pressed steel plates for car springs, are trying to keep up with their orders, but find it very hard to do so. Their exhibit at the conventions attracted considerable attention and was productive of good results.

Jackson & Sharp Company, Wilmington, Del., have just completed and delivered to the Lehigh Valley Railroad Company three passenger and three combination cars. They are also building six passenger coaches for the Richmond & Danville Railroad and two for the Cincinnati, Wabash & Michigan railroad.

The Safford automatic draw bar has recently been applied to several thousands of cars, and as an automatic coupler is said to retain the popularity the plain coupler invented by the same mechanic held so long among brakemen and others who are brought in intimate contact with all kinds of draw bars.

CYPRESS SHINGLES is the title of a beautifully illustrated pamphlet published by Vanderbilt & Hopkins, New York. The object of the pamphlet is to set forth the durability of the cypress wood, which the firm deals in, and in doing this the compilers have shown exquisitely produced illustrations of a great variety of old buildings that have become historical edifices.

VALENTINE & Co., New York, the well-known varnish makers, have lately issued a business card of about the size of a silver dollar, made of aluminum, the novelty of which renders it interesting to every intelligent observer of events which mark the progress now making in science and art. The extraordinary lightness of the medal impresses the holder with the peculiar characteristic of the metal from which it is made.

During the past month the Fowler Rolled Steel Car Wheel Works have taken orders from about sixteen important roads, prominent among which they have received during the past few days orders from the Great Northern Railway of St. Paul for 500 wheels; Chicago, Rock Island & Pacific Railway, 100, and two other leading railroad systems for 200 and 400 respectively. Since the production of their own steel the wheel is coming rapidly to the front.

As the testing of railroad employés for color-blindness is a practice that must be followed by all railroad officers who feel a proper responsibility for the safe operating of trains, many persons concerned in having the tests properly made will be interested in an apparatus prepared by James W. Queen & Co., Philadelphia. The apparatus provides everything that is necessary for examination of vision and hearing. It is cheap and much more efficient than anything likely to be got up by railroad men themselves.

The Michigan Railway Supply Company say:-

It is very essential in this age of air-brakes to know which is the safest, most reliable, and most durable metal brake-beam manufactured.

To settle this question beyond all reasonable doubt, the Michigan Railway Supply Company, of Detroit, make the following proposition for a practical working test:

We will equip from 25 to 100 cars for any trunk line in the United States with our improved "Central" Steel Brake Beams, fitted up completely with any style of brake-head, any or all of our competitors to do likewise. The cars are to be placed in active service and an accurate account kept of repairs of any kind made to any of the brake-beams during the first 12 months of service, the cost of the repairs to be charged against the beams having such repairs made to them.

At the expiration of the 12 months the manufacturers of the beam showing the best results shall be paid the regular selling price of the beams furnished for the test, by the manufacturers of the other competing beam, or beams, share and share alike.

In case 12 months' service is not long enough to arrive at the result, a sufficient additional length of time, as decided by the railroad company making the test, is to be allowed them.

First Drummer---On the Pennsylvania Railway a few days ago a locomotive lost its smokestack in a collision. Well, sir, they just stuck a barrel over the hole and went right along as if nothing had happened.

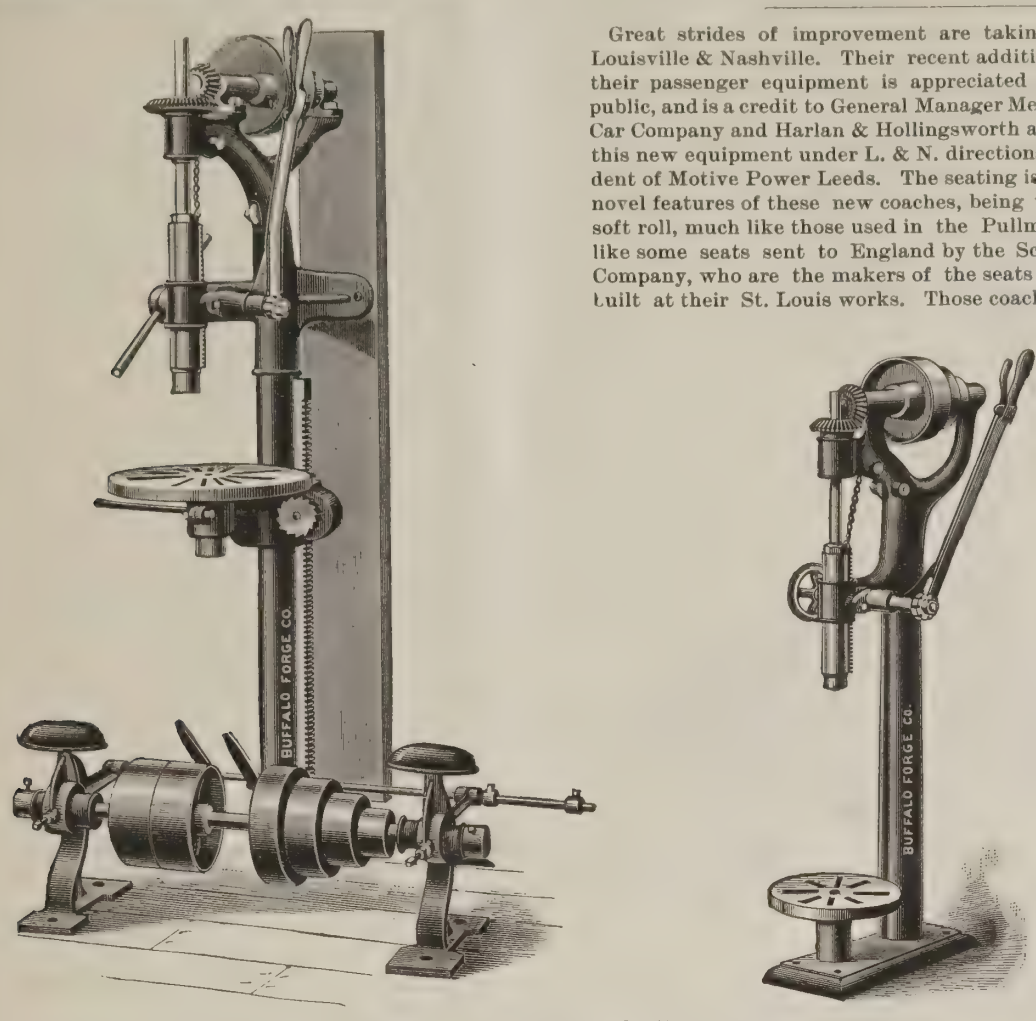
Second Drummer---That reminds me of an accident tha happened to a train that I was on recently. The engine jumped the track and was smashed all to flinders; but in five minutes we were moving along toward the next station, where we arrived only a little late.

"Humph! How could that be?"

"We got out and walked."

Improved Upright Power Drills.

The drills illustrated by the accompanying engravings represent two of a large line of drilling machines for various uses made by the Buffalo Forge Company, Buffalo, N. Y.



IMPROVED UPRIGHT POWER DRILLS.

Both designs have machine-cut gears, running perfectly noiseless, the spindles taking a ¾-inch Morse Taper Shank and will drill up to a 1¼-inch hole. The larger drill, No. 87, will drill to a centre of 20-inch circle. A special attachment for carrying wheels when drilling the tire is afforded for the No. 87 drill which is especially adapted and designed for the work of carriage and wagon makers, which feature is much appreciated by users of this kind of drill, as it greatly facilitates the work. This machine is arranged for four changes of speed, and is provided with adjustable table for raising and lowering to meet the demands of different classes of work, weighs 320 pounds and is 66 inches in height.

The smaller, No. 83, will drill to a center of an 11-inch circle, having three changes of speed, is 50 inches high and weighs 150 pounds.

The new design of countershaft shown with No. 87 is adapted for tight or loose pulleys and is made in suitable sizes for the smaller power drills. The bearings, which are of the ratio of 4 to 1, are solid, not babbitted, and bored out and reamed to gauges of cast iron, which increases their lasting qualities. It is also provided with hanger and shipper arm, all of one piece, which is a great convenience in putting up the hanger. The length of countershaft is 32 inches, diameter of pulley 8 inches, and should be run at 250 revolutions per minute.

All working parts of these drills are made of best material from accurately fitted templates.

The ever progressive Chicago & Alton have overdone themselves in their recent equipment for passenger service. General Manager Chappell has issued orders to Master Car Builder Joe Townsend for a lot of new coaches, and they are now under way at the Bloomington shops. These new cars are to be the pride of the road, and are equipped with all that modern ingenuity can contrive for the comfort of the passengers. The seating is, of course, the most conducive, and the Scarritt chair and seats are to be used. They are especially designed, high back, richly carved and beautiful seats, and a credit to the road, as well as the Scarritt Furniture Company, the makers.

The Turnbuckle Depatment of the Central Iron and Steel Company, of Brazil, Ind., is running night and day to supply the large demand for their patent wrought iron turnbuckles. The company has been obliged to put in additional machinery in order to supply the rapidly increasing demand for this meritorious article, and they are now prepared to furnish a large variety of sizes.

The Consolidated Car Heating Company had a particularly interesting exhibit at Old Point Comfort. They had three exhibits showing by glass tubes and glass reservoirs the arrangement of the different methods of car heating handled by the company, and water containing colored sediment was used to show how the water circulated when steam was applied. The working of the different systems was very lucidly explained by officers of the company who were present, and it is safe to say that many railroad men came away from the convention with a much clearer idea of how car heating was done than they ever had before.

Great strides of improvement are taking place in the Louisville & Nashville. Their recent addition of 15 cars to their passenger equipment is appreciated by the traveling public, and is a credit to General Manager Metcalf. Ohio Falls Car Company and Harlan & Hollingsworth are each building this new equipment under L. & N. directions of Superintendent of Motive Power Leeds. The seating is one of the most novel features of these new coaches, being very high with a soft roll, much like those used in the Pullman coaches, and like some seats sent to England by the Scarritt Furniture Company, who are the makers of the seats and which were built at their St. Louis works. Those coaches are to run on the New Orleans-St. Elevated trains in connection with the Pullman Vestibule, and no line offers better service.

MACHINED CAR WHEELS is the title of an illustrated pamphlet published by the New York Car Wheel Works, Buffalo, N. Y. The publication is devoted to explaining details of the company's method of manufacturing wheels which are reputed to meet the following conditions: "A perfect car wheel must be absolutely safe, mechanically perfect and economical for service. What we have done toward attaining these ends may be determined by the fact that out of a tota of 500,000 wheels made in the past five years and put into every kind of service on the leading railroads of America, not one case of breakage has occurred: that we command the means for furnishing wheels in an absolutely perfect mechanical condition, and that we can supply such wheels at the ordinary market price paid for good chilled car wheels."

One of the most interesting exhibits shown at the Old Point Comfort convention was the Boyden brake apparatus. The exhibit was placed in a large tent at the back of the hotel, and consisted of a Boyden air pump, and eight brake cylinders with all attachments, and one Westinghouse cylinder. Sectional valves were also exhibited to make the design of the parts intelligible to those interested in the brake. The brake is made to interchange with the Westinghouse connections, and exhibits were made of the working of the two brakes together, and the brakes worked as perfectly as could be desired in making all kinds of stops. We are informed by the Boyden Brake Company that their apparatus has been applied to rolling stock belonging to the following railroads: Baltimore & Ohio, Baltimore & Ohio Southwestern, New York, Susquehanna & Western, Western Maryland, Cin., N. O. & Texas Pacific, Lake Erie & Western, Brooklyn & Brighton Beach, Duluth & Winnipeg, Raleigh & Gaston, Wilmington, Columbia & Augusta, Seaboard & Roanoke, South Carolina and Chicago & Eastern Illinois.

New Smoothing Planer.

The machine illustrated by us is constructed on a new principle, and in such a manner as to combine great strength and solidity, two great factors which tend to make perfect smoothing planers. Various sizes of this machine are made, from 24 inches up to 36 inches wide. It is a production of the well known manufacturers of wood working machinery, the Egan Company, of Cincinnati, and is further described by them as follows:

The frame is entirely cored and very substantially braced, making a very stiff and suitable frame for a machine of this class.

The table is dovetailed in the frame and raises and lowers on long inclines by means of two screws operated by a hand-wheel convenient to the operator. This means of adjusting the bed is acknowledged to be the very best known, as it makes the bed absolutely solid and free from vibration, the bed having more support beneath it than can be obtained in any other way.

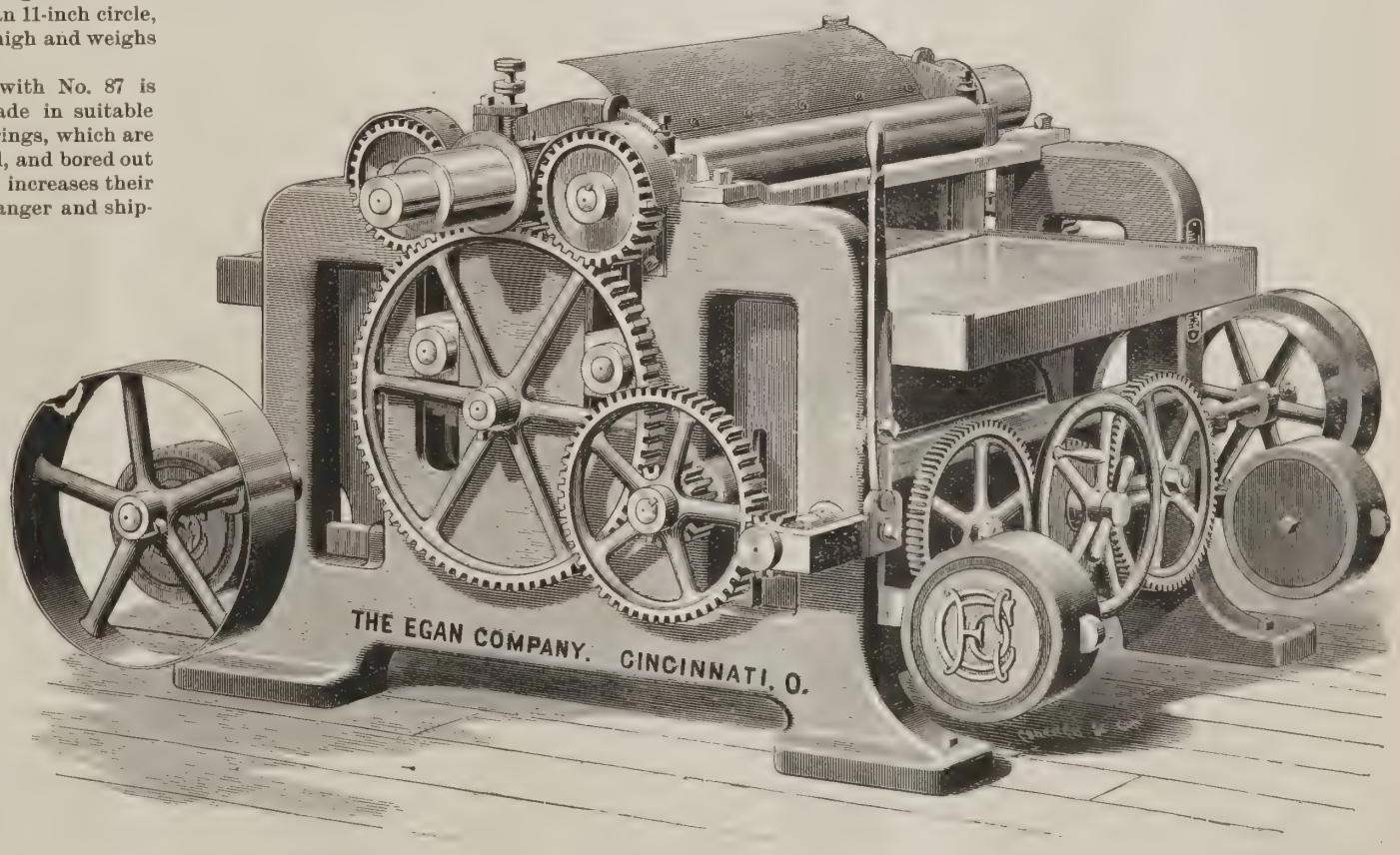
The feed consists of four powerfully geared feed rolls of large diameter, making a feed that can be relied upon as being first-class in every particular. The feed rolls are weighted on an improved principle, the weights being adjustable, to give more or less pressure as desired. There are two speeds to the feed, and we can assure wood-workers that this machine will do smoother work at its fastest feed than has heretofore been attained on any other smoothing planer at a much slower speed.

The cylinder is four-sided, so as to use either two or four knives as may be desired. It is double belted, and the feed is run directly from it. There are pressure bars on each side of the cylinder, arranged on a new principle, and work to the circle of the head, thus preventing all tearing out of wavy grained or knotty stuff, either narrow or wide, or clipping of ends, which is so common with many smoothing planers.

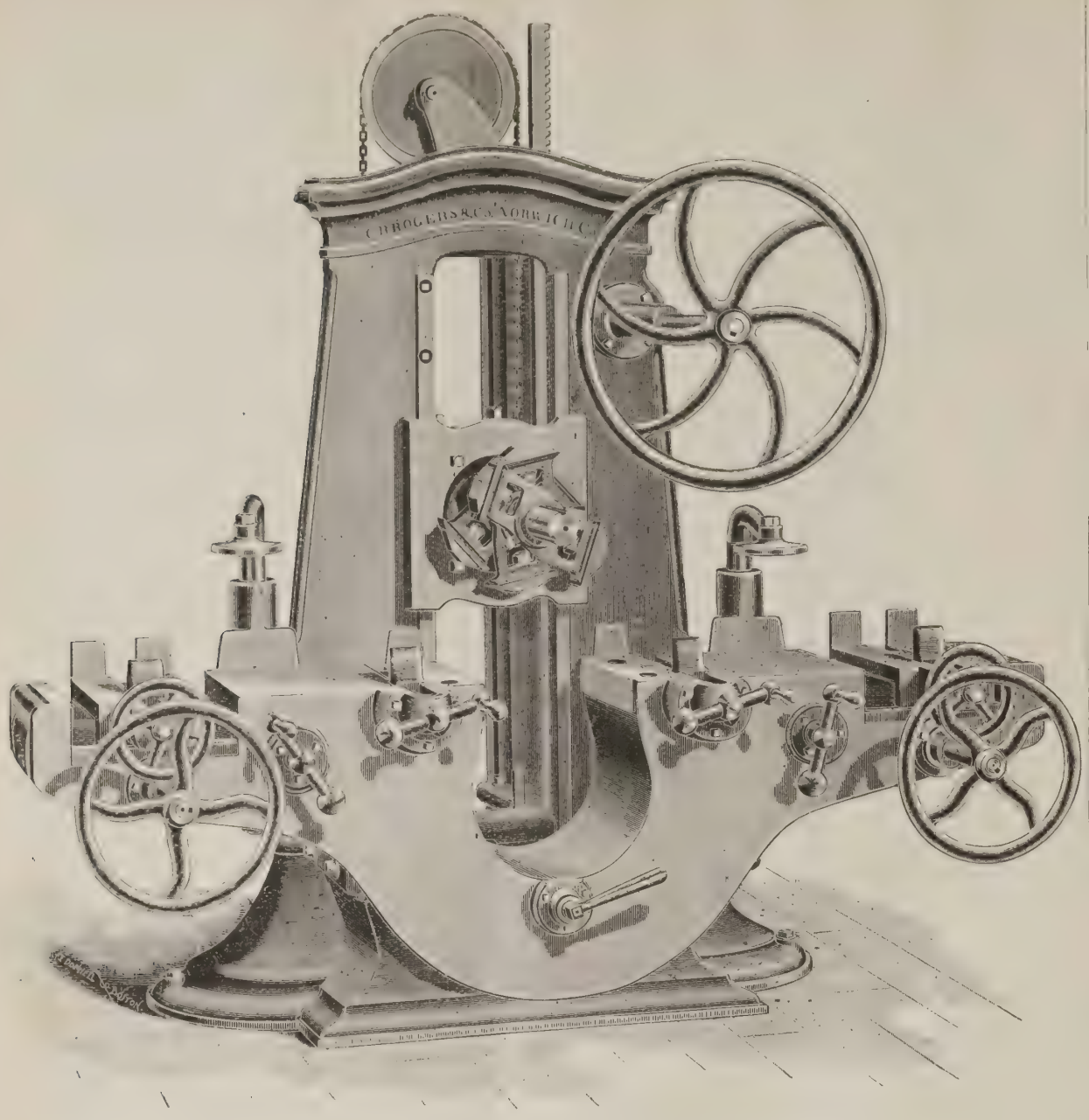
One of the greatest advantages of this machine, especially in the wide sizes, is that the stock can be run diagonally under the cylinder, which is far better than running a cylinder in a diagonal position, as it permits straight belts being run to the cylinder and the planing of short stuff. It is specially adapted for planing framed stock where straight and cross-grained wood is built up, and which heretofore has given furniture manufacturers any amount of trouble on account of their not being able to plane this particular kind of work. That it will do this kind of work perfectly is sufficient to recommend it to the trade.

Furniture manufacturers, who have wide hardwood table tops or other glued up work to plane, and who have not found heretofore a tool to do the work satisfactorily, will be more than pleased with the work done on this machine, and will be astonished at the rate it will do it. For planing mills wagon and carriage factories, it will be found a valuable acquisition, and for piano and organ work, which necessarily must be perfectly smooth, it will excel any other machine, as no better tool can be found to prepare work for a sander while its great capacity fits it for general planing.

Further particulars may be had by writing the manufacturers at 235 to 255 West Front street, Cincinnati, O.



NEW SMOOTHING PLANER.



VERTICAL CAR TENONING MACHINE.

This new and valuable machine, made by C. B. Rogers & Co., Norwich, Conn., is designed to meet the wants of car car builders and railroad shops, being adopted to tenoning car sills and timber up to 16 inches square and any extra heavy work. The machine is very heavy, made entirely of metal, and in a most workmanlike manner. The working parts are a table on which the timber is laid, and held in place by improved adjustable clamping screws, which are instantly set by the cranks in front. The bed also adjusts to and from the column by the screw at the base, and is provided with a movable section on either side of the cutter head for end adjustment of the timber to the cutters.

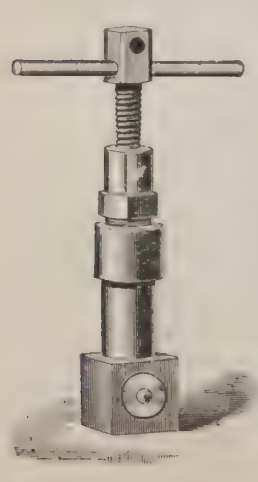
The cutter heads consist of three sectional heads, of cast steel, cutting tenons 4 inches long, adjustable to any distance apart on their arbor, which runs in a frame gibbed to the column, and is balanced by a weight, the whole moving freely in a vertical direction by the operation of the large hand wheel in front.

The timber to be worked, being clamped to the movable section of table, is by means of the hand wheels moved endwise to proper relation to the cutter head. The latter in its downward motion cuts the tenons on one end, and the timber being moved laterally on the table, and clamped, the head in its upward movement cuts the opposite end. A gauge is provided on the table to set the work by. The machine should rest on a solid foundation, which may be made 5 feet square for the base. A countershaft and standard are furnished with the machine.

The tight and loose pulleys on counter are 12-inch diameter, 8-inch face, and should make 400 revolutions per minute, giving 1,600 to the head. Weight of machine, 5,800 pounds.

Piston Rod Remover.

This little tool has been designed to put in between crosshead pin and the end of piston rod of Locomotives, for the purpose of forcing the latter out. The space available being frequently not over 1¾ inches makes a very compact tool necessary, and one which can be used without hammering, as that injures the pin and damages the piston rod.



This little tool has a pushing capacity of over 15 tons, easily applied, and a motion of ⅝ inch to the rams.

It is made by Watson & Stillman, New York.

The Pennsylvania & Northwestern Railroad Company have had the Smith exhaust pipe on some of their locomotives for about a year, and the master mechanic claims that the device has effected a saving of 70 per cent. in coal and that it prevents the throwing of sparks.

Major J. C. Paul, late general manager of the Woodruff Sleeping Car Company, and superintendent of equipment of Pullman Car Company, has been appointed vice-president of the American Steel Car Wheel Company, of Boston, and will have the general charge of the sales department, with his office at 115 Broadway, New York.

EFFICIENCY OF CHAIN BLOCKS is the title of a pamphlet issued by the Yale & Towne Manufacturing Company, Stamford, Conn. The publication relates principally to investigations into the efficiency of different forms of the Western block. There is an interesting report on the subject by Professor Thurston. Every one interested in differential pulley blocks ought to send for the pamphlet.

Mr. J. B. Mulliken, general manager of the Chicago & West Michigan, writes saying that he considers the Fontaine safety signal one of the most valuable inventions for promoting safety of travel that has been brought out since the Miller platform and coupler were invented. The object of this safety signal is to indicate to the locomotive engineer of a passing train the length of time that has elapsed since the preceding train passed, so that he may keep a safe distance behind it, and thus avoid the danger of a collision arising from trains following each other too closely.

We have received a very good photograph of Kings County Elevated Railroad car 192, showing very clearly the working of the deck sash apparatus made by the International Manufacturing Company, New York. This improvement in car ventilation permits every window to be opened in either direction. All the windows on one side can be operated simultaneously from either end of the car. The window openings are controlled to the exact degree required, and provide non-localized ventilation, thus ventilating all parts of the vehicle equally and well. If it be so desired, however, the appliances can be adjusted to work the windows singly, or in pairs, or any number together.

The Johnston Electric Train Signal Company have purchased a valuable property in Woburn, Mass., which they will occupy and utilize immediately as a factory. The building is four stories in height, has a frontage of about 100 feet and is upward of 200 feet long. It is located near a railroad and its facilities are excellent. The company will set up its machinery at once and it is expected that a hundred mechanics will be at work within a month. The purpose of the concern is to manufacture not only the train signal, but push-buttons of all descriptions and several electric hardware appliances. The train signal was shown at the Old Point Comfort conventions and attracted much attention on account of its simplicity and efficiency.

The following officers and directors of the Consolidated Car Heating Company have been elected for the ensuing year. The only change of special importance is the election of Mr. George Westinghouse, Jr., as vice-president: Directors—Robert C. Pruyn, George L. Walker, D. D. Sewall, George Westinghouse, Jr., Alfred S. Hatch, Anthony N. Brady, George M. Gray, Charles J. Peabody, H. S. Osgood, R. C. Blackall, J. H. Sewall, J. F. McElroy, William G. Rice, Albion Little, Caleb H. Jackson. Officers—President, Robert C. Pruyn: vice-president, George Westinghouse, Jr.; vice-president, William G. Rice; secretary, Charles J. Peabody; treasurer, William G. Rice; general manager, Daniel D. Sewall; mechanical superintendent, James F. McElroy; assistant general manager, J. H. Sewall.

Our Directory.

Atlantic & Danville.—E. T. Smith has been appointed general superintendent, with office at Portsmouth, Va.

Chicago, Burlington & Northern.—D. Cunningham has been appointed superintendent.

Chicago, Burlington & Quincy.—W. F. Merrell has been appointed general manager. W. C. Brown, the superintendent of the Iowa lines has resigned.

Chicago & Eastern Illinois.—J. R. Lawrence, foreman of the Columbus, Hocking Valley & Toledo car shops, has been appointed master car builder, with headquarters at Danville, Ill.

Chicago & Northwestern.—E. J. Cuyler has resigned the position of superintendent, and is succeeded by W. A. Gardner.

Cleveland, Cincinnati, Chicago & St. Louis.—Edward Hill, Purchasing Agent, has resigned, and the jurisdiction of J. A. Barnard, Assistant General Manager, has been extended over that department.

East Tennessee, Virginia & Georgia.—W. A. Vaughan has been appointed superintendent.

Fort Worth & Denver City.—O. O. Winter has been promoted to the position of superintendent, to succeed R. J. Duncan, resigned.

Georgia Pacific.—William H. Owens has been appointed master mechanic, with headquarters at Birmingham, Ala., vice W. T. Newman, resigned.

Hannibal & St. Joseph.—W. C. Brown has been appointed general manager.

Michigan Central.—W. A. Vaughan, superintendent, has resigned, and is succeeded by W. J. Martin.

Minneapolis, St. Paul & Sault Ste. Marie.—F. N. Finney has been elected president. T. A. Fraser, master mechanic, has resigned.

Mobile & Ohio.—H. W. Clark has been appointed superintendent.

New York, Lake Erie & Western.—A. A. Gillis, of the Elmira shops of the Erie, has been made master mechanic of the Delaware division. Mr. Geo. B. Ross has been appointed master mechanic of the Buffalo division, vice J. H. Murphy, resigned.

Norfolk & Virginia Beach.—J. M. Dickey has been appointed general superintendent, in place of G. M. Hughes, resigned.

Ohio & Mississippi.—J. N. Seale has been appointed superintendent.

Orange Belt.—William Macleod, treasurer, has been appointed general manager.

Pennsylvania.—F. L. Sheppard has been appointed general superintendent, with office at Altoona, vice Robert E. Pettit, resigned; J. M. Wallis, superintendent of motive power, with office at Altoona, vice F. L. Sheppard, promoted.

Pittsburgh & Western.—H. C. Boughton has been appointed superintendent of the Western and Lake divisions.

Seaboard & Roanoke.—John H. Winder has been appointed superintendent.

Shenandoah Valley.—D. W. Flickwir, superintendent, having resigned, Thomas H. Bransford, auditor of the company, has been appointed to the position.

Spokane Falls & Northern.—J. Hamill has been appointed superintendent, vice J. M. Buckley resigned. O. D. Mott is purchasing agent.

Union Pacific.—Edward Dickinson has resigned the position of general manager. F. L. Corwin, assistant superintendent of the Wyoming division has been appointed superintendent of the Utah division of the Mountain division, with headquarters at Salt Lake, Utah, succeeding Mr. W. W. Riter, resigned. Mr. R. T. Hilliard, trainmaster at Laramie, Wyo., has been appointed assistant superintendent at Green River, Wyo., in place of Mr. Corwin, promoted. J. B. Gilchrist, assistant superintendent of the Colorado lines has resigned. J. O. Brinkerhoff has been appointed general manager. A. T. Palmer has been promoted from assistant to superintendent.

Wisconsin Central.—James McNaughton has been appointed superintendent of motive power to succeed John Player.

Employment.

WANTED—Situation as a coppersmith and pipe worker in a railway shop. Address H. J. C., Box 276, Milton, Pa.

WANTED—A master mechanic who has had considerable experience in charge of motive power and cars desires a situation. Address N. W. Z., care this office.

WANTED—Position as foreman boiler maker in a first-class place. Will furnish the best reference as to fitness. Address H. C., Box No. 3, New Haven, Pa.

A mechanic, thirty-seven years old, who has six years' experience as master mechanic, wants a position as master mechanic or general foreman. Will go to any part of United States or Mexico. Best of references given. Address F. B. M., Box 940, McKeesport, Pa.

WANTED—Position by a Master Car Builder. The advertiser is a young married man, with fifteen years' experience in building and repairing passenger and freight cars. Reference and particulars furnished. Address "W. N. C.," care NATIONAL CAR AND LOCOMOTIVE BUILDER.

NATIONAL CAR AND LOCOMOTIVE BUILDER

AUGUST, 1890.

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The Zanesville & Ohio River has placed an order for 350 freight cars.

The Norfolk & Western has just added three new postal cars to its rolling stock.

The East Tennessee, Virginia & Georgia has placed an order for 200 freight cars.

The Peoria & Pekin Union road has recently placed a contract for two mogul engines.

The Harrisburg Car Manufacturing Company has the order for 300 gondola cars for the Huntingdon & Broad Top Mountain road.

The Pennsylvania & Northwestern has awarded a contract for building 200 coal cars to the Lebanon Manufacturing Company.

The Bloomsburg Car Company, of Bloomsburg, Pa., has received an order for 200 gondola cars for the Zanesville & Ohio River road.

The Ohio Falls Car Company, of Jeffersonville, Ind., was awarded the contract last week for building 1,450 cars for two Southern roads.

The Railway Equipment Company, of Chicago, Ill., has been incorporated with a capital stock of $100,000, by John Veeder, A. R. Barnett and Wm. M. Reem.

The American Concave Spring Company is incorporated with $30,000 capital stock and an office in Jersey City. The company will manufacture and sell springs.

The Louisville, New Orleans & Texas is reported in the market for 600 freight cars in addition to the lot recently ordered of the Missouri Car and Foundry Company, of St. Louis.

The office of the superintendent of motive power of the Union Pacific has been moved from Omaha to Cheyenne, Wyo., where new shops belonging to the company are now in operation.

The Association of Railway Accounting Officers held a convention at Cape May on July 9 and 10. There was a good attendance, and several papers relating to railroad accounts were read.

The Nashville, Chattanooga & St. Louis has given an order to the Rogers Works for building 20 freight locomotives. The company has ordered a large number of cars from the Ohio Falls Works.

Train collisions have been so frequent on the Louisville, New Albany & Chicago since the change of management that the chief train dispatcher has resigned, although he has not been responsible for any of the accidents.

The plant of the Mount Vernon Car Manufacturing Company, of Mount Vernon, Ill., will be ready for production within a few weeks. The first order turned on will consist of 200 double hopper bottom cars for the Louisville & Nashville.

The Baltimore & Ohio Railroad Company, among other improvements, are introducing the use of water troughs on the track to enable the locomotives pulling fast through trains to scoop up the supply of water to fill the tender while running.

The Steel Tubular Car Company has been organized, and it is reported that they intend erecting a large plant near Bradford, Pa., for the manufacture of steel tubular cars for passenger service. The car is the invention of Mr. John W. Post, who is general manager of the company.

The Lake Shore & Michigan Southern have entered upon the practice of using retaining rings for the driving wheel tires of their locomotives equipped with driving brakes. The Baltimore & Ohio Company have decided to abandon the use of fastenings for driving wheel tires and depend on the hold secured by shrinkage.

Mr. Thomas Rogers, the founder of the Rogers Locomotive Works, did more than any other man to introduce the use of the link motion on American locomotives and to make the mechanism a success. It is a very eloquent testimony to the ability and mechanical judgment of Mr. Rogers that to this day the works have never had occasion to change from the original proportions of the link motion adopted by him when it was first introduced.

A meeting of railroad men was held some time ago at a place famous for the fishing in the neighborhood. The delegates attended pretty closely to the sessions of the meeting, but fishing that proved by no means satisfactory occupied the lion's share of attention. There was a small meeting house near the hotel and a considerable portion of the visitors attended service on Sunday. The preacher displayed a delicate appreciation of the situation by discoursing from the text "We have toiled all the night and caught nothing."

The West End Railway Company, of Boston, have 100 miles of track operated by electricity. When the system is completed there will be 250 miles of street railways operated in that way. At present the lines are operated by temporary plants that will be used till the permanent plant is finished. On the night of July 4, when the great crowd which witnessed the fireworks on the Common was riding home, the ampère meters showed a total of about 3,900 horse power generated at the central station.

When recently in Pittsburgh we enjoyed an interesting visit to the works of Howe, Brown & Co., and examined one of the largest and most complete plants in the country for the production of crucible steel. The company make a specialty of tool and spring cast steel, but they have also large facilities for making open-hearth steel, and the product in this department is gaining rapid favor among boiler users. From the analysis we have seen of fire-box steel we should judge that the sheets produced here for that purpose would give as good service under hard usage as anything that is made.

The third meeting of the American Boiler Manufacturers' Association began Tuesday, at the Park Avenue Hotel. New York. After the address of welcome by the president, Mr. Lappam, the secretary read a report recommending the formation of an American boiler manufacturers' insurance company. An incomplete report on manheads and manholes was read and referred to another committee, A. H. Raynal, chairman. A discussion on uniformity in State inspection laws regarding boilers brought out the fact that only three States have inspection laws. A committee was appointed to formulate a uniform plan of legislation on boiler inspection to be recommended to all the States.

The startling news was sent over the country one day last month that a train robbery had been attempted near Van Wert, O., and that the engineer of the train had been murdered while resisting the robbers who tried to stop his engine. An investigation of the case by the police has led to the arrest of the fireman who is charged with committing the murder. The fireman protests his innocence, but there appears to be strong evidence against him. The two men on the engine were known to have been quarreling all day, and it is supposed that the engineer knocked the fireman down among the coal for he was badly hurt about the head, and that the latter seized a copper hammer which was found covered with blood and killed the engineer by a murderous blow on the head.

The intensely hot weather in the beginning of July led to a highly dramatic scene on a passenger train of the Chicago & Northwestern railroad. The heat so affected the brain of the fireman that he suddenly became violently insane, and made a murderous attack upon the engineer. Both men engaged in a terrific death struggle, and the engineer was so suddenly attacked that he had no time to close the throttle, and the train rushed on with no one in control while the two occupants of the cab wrestled for supremacy, the maniac fireman trying to throw the engineer off the engine, and the engineer exerting almost superhuman efforts to overcome his assailant. The struggle was so protracted that the engine slowed down for want of steam, the fire having burned low. This attracted the notice of the other trainmen, who went to the assistance of the engineer, and helped to overcome the violent lunatic.

An item is going the rounds of the daily papers which strikingly illustrates how little those who edit such papers know about engineering matters, and how little common sense is expended in the consideration of engineering statements. There has been a sort of mild public protest against the practice of ocean steamers racing, and a leading New York daily announced to its readers that it had induced one transatlantic line to reduce speed. The speed of the screw propeller, the newspaper says, will be reduced three revolutions per minute, and the effect will be to increase the length of the voyage about two hours. We would like to know how that was figured out. The screw generally turns about sixty revolutions per minute, and that forces the ship ahead say 1,700 feet per minute. To a man of common sense, who was not accustomed to engineering matters, it would appear that reducing the revolutions $\frac{3}{60}$ would reduce the speed in the same ratio, and that an eight-day voyage would be lengthened about nine hours.

Engineer Way, who in March larch last killed a Mexican who, with three others, was trespassing on the track near Torreon, was liberated last Sunday from his enforced residence in Matamoros de Laguna. An essential preliminary to his acquittal under Mexican criminal procedure, was that Way, with the identical engine (the identical cars were also requested, but could not be forthcoming), a similar number or weight of cars, running at the same speed, should demonstrate on the spot where the accident occurred, precisely how it happened in order that the judge, who was on the engine, should be able to come to a conclusion as to the guilt or innocence of the engineer. The engineer went through the movements, applying the air suddenly. The judge nearly fell off, and was abundantly satisfied that the killing was unavoidable, and says that the next time such an experiment is desired by his superior court, the superior court should make it. The result is that Way is exonerated from all blame. While at Matamoros he had the freedom of the city.—*Two Republics.*

Press dispatches from Bradford state that a tract of 5,500 acres in McKean County, near Bradford, has been purchased by the Steel Tubular Car Company and upon it will be located the town of Charmony, which it is expected will rival Pullman as a car-building metropolis. A model city is to be laid out with neat cottages, perfect drainage, water and light systems, and all under the control of the company. The capital of the company is $5,000,000, half of which was secured a few days since by an English syndicate: the remainder is in the hands of people throughout the United States. John S. Orr, of New York, is president; Col. A. I. Wilcox, vice-president; John W. Post, general manager, and the following board of directors: Henry E. Perrine, Harlon C. Palmer, John G. Valentine, Col. J. A. Marrow, Givon Pike, H. C. Low, M. T. E. Chandler, Col. R. F. Young, H. D. Money and E. John Ellis. The main building is to be E-shaped, having three fronts of 644 and two 580 × 60 feet, five stories high, each 18⅜ feet, built of stone to the third story, the remainder being brick.

The annual statement of railroad accidents in New Jersey has been published by the State Controller, to whom each railroad is required to furnish a report of every occurrence that causes death or injury on any part of the route. There are 3,748 miles of railroad, and in the twelve months 749 persons were injured, 236 fatally. Two-thirds of those injured were employés, and half of the grand total were hurt in coupling cars, while of those killed less than one-third were employés. The secret of this is that the killed were, in a large measure, tramps walking on the track and struck by trains. The disastrous consequences of the present system of coupling freight cars by the old-fashioned pin-coupler is clearly shown, and offers a strong argument for action to compel the use of an automatic coupler. It appears that nothing short of making trespassing on railroads a crime will prevent people from indulging in the dangerous practice of walking on the tracks. Many accidents happened at highway crossings, and some agitation is going on to compel railroad companies to introduce better protection against accident at such places. In regard to this we would strongly commend the use of audible signals that cost little, are efficient and certain in their action when looked after.

Very much to the discredit of the railroads concerned the switchmen and brakemen of Missouri considered it desirable to petition the railroad commissioner to compel railroad companies to put fillings in the frogs and switches to prevent men from getting their feet caught. The commissioner replies: The law in this State does require all railroads to block frogs and guard rails with the best known device, but we have no power to compel a compliance with this law. It is left optional with the roads here, there being no penalty prescribed beyond that of depriving the companies of the right to prove contributory negligence. The commissioners in some of the Eastern States have supervision over matters of this kind. Of course, the railroad officials are not indifferent as to the safety of their employés, and will be found ready to adopt some permanent device that will not be likely to be shortly discarded for something that might claim to be better.

The best thing and the most complete prevention against accidents of this kind is the Mahoney foot guard for frogs and switches. With this device in use it is impossible for any person to get his foot caught. Col. Breathett and I have already examined and tested this guard and have approved of it, and have recommended its adoption by the railway officials of the country. This is all we can do under the present law. I think I am justified in saying that it will pay any road to adopt it, and also save a number of lives and limbs.

Proceedings of the Railway Master Mechanics' Convention.

The twenty-third annual convention of the Railway Master Mechanics' Association met in the Hygia Hotel, Old Point Comfort, Va., June 17.

President Briggs called the meeting to order and requested the Rev. George Royal to invoke the divine blessing on the meeting. President Briggs then introduced Mr. Ingalls, president of the Chesapeake & Ohio, who delivered a most eloquent, historical and interesting address of welcome, his principal theme being Virginia.

PRESIDENT INGALLS ON RAILROAD MATTERS.

In the opening portion of his address Mr. Ingalls said:

It is hardly worth your time for me to discuss the particular matters which you will consider at your meeting. I know but little about engines, wheels, axles or cars, while you are full of information. I am delighted to see so many here and representing such large interests in this country as you do. Probably your associations, with their ramifications, including supply men and employés, represent more of a population than the whole of the United States contained in 1830, when the first railroad was inaugurated. It cannot but be of benefit to you and to the railroads that you meet together and discuss matters of interest. Another reason in favor of such meetings, and equally good, is the fact that it gives you a few days rest from hard work, enables you to see something outside of the shop and to get a few bright moments in life where pleasure and not work is the rule of the hour. We are indebted to you for having selected this place, and certainly no fairer one could have been found for your meeting. As far as the Chesapeake & Ohio Railway is concerned, I am authorized to say that its doors swing wide open in hospitality to you, and whatever you want, from the salt sea waves at this end to the waters of the Ohio at Cincinnati, you can have. We hope that either in coming or going, or while here, you will take a ride over it and look at it. We are proud of it. A few years ago its name was a by-word and reproach among railroads. To-day it can compete with any in track, equipment and business, and in the *esprit de corps* of its men it will not yield to any. All this has been accomplished in a short time, and we would be glad to have you view it critically. Not long since its stocks and bonds were selling for almost nothing, and financial people hesitated to admit that they were the owners of the same, but to-day its securities are current in the financial markets of the world as among the best, and we hope to make them still better. We can only do so by having such men as yourselves visit us, ride over the property and see it.

Mr. J. Davis Barnett moved a vote of thanks to Mr. Ingalls for his address of welcome, which was enthusiastically adopted.

PRESIDENT'S ADDRESS.

President Briggs then delivered his inaugural address as follows:

Brethren of the American Railway Master Mechanics' Association, Ladies and Gentlemen:

In the name of our honored society I rise to give you a hearty greeting.

As we follow the example of our locomotives in the power to move from place to place, it is eminently right and proper that our convention should meet at "Old Point Comfort," where a new application of mechanics was successfully demonstrated by the genius of Ericsson in his famous monitor, awakening and revolutionizing the navies of all nations. It is to Ericsson that we also owe the screw propeller, now in our day enabling the "greyhounds" of the ocean to plow the deep, transporting the people of all continents with such speed as to annihilate space and challenge the admiration of the world.

This man struggled to impress upon the minds of the scientific men and the capitalists of England, the advantages of the screw propeller, and was forced to abandon his efforts for want of encouragement; but in this country, where genius never applies in vain, the worth and value of his invention was recognized and appreciated, resulting in the steamship "Princeton" being equipped with that then called myth, now recognized as one of the greatest agencies of mankind in the locomotion of the steamship from shore to shore.

The prosperity of our country since our last assembly has been attested by a large additional railroad mileage, and we learn from reliable sources that more miles of new railroad will be built this year than in 1889. When we reflect that the extreme boundaries of our country are already connected by existing railroads, from the oceans that bathe our Eastern and Western shores to the Canadian and Mexican limits, we see at once that our railroads are not to reach new territory in any great bound, but are in the natural development of our internal country; and we, as master mechanics, have for our special work, not the creation of any new machine to accomplish locomotion, but rather the evolution of our present engine, that we may reach the highest efficiency in speed, in power, in durability and in safety, at the least cost in its original construction, combustion properties and expense of keeping up.

While the old wood-burning engines have generally given way to the modern coal burner, it is quite probable that in some sections of our county other fuel than coal may be successfully used, and we invite from all sections the suggestion of our associate mechanics to this important item in the cost of steam making.

The great diversity of territory through which our locomotives travel would seem to prevent anything like national uniformity in construction; severe grades demanding features in the engine not required over prairie country, and other special forms provided for use in special localities; but when we travel through our country and see the different locomotives at work, we cannot but be struck with the great similarity of these powerful machines, and we feel a glow of pleasure in the knowledge that the existing uniformity and excellence has been attained more through the labors of this association than from any other influence. This thought inspires us with confidence in our progression, and we look forward to our annual convention in the full security of individual improvement as members, and enlarged and enlightened service for the companies we represent.

As we contemplate the immense work that our locomotives have been made to perform in the transportation of the harvests from the prairie to the seaboard, in the movement of all living and dead freight, creating cities, establishing markets, breathing life and civilization, making the "desert even blossom as a rose," let us not forget the grand army of faithful engineers and firemen to whose care these vast machines are entrusted; an army of men larger in numbers, stronger in discipline, richer in intelligence and higher in bravery than any of whom Alexander could ever boast. These men, largely recruited from humble life, form a perpetual monument to the mothers who gave them birth, true type of our American womanhood, who sent her boys to school and struggled so often with poverty and privation that her children should have every opportunity for gaining knowledge, and who by a lifetime of devotion has encouraged and fortified us all in the development of our progression.

Let us thank God for what has been gained, but let us not think that everything has been gained; much has been done, but much remains to be done. Science is daily improving our knowledge as to the combustion of fuel; mechanics is daily improving the learner in the care of these machines. It is not necessary now as in former days, when you and I were young men and members of the rank and file, to search after this knowledge—by the aid of a tallow candle perhaps: the knowledge thus obtained by those early pioneers of progress has been so concentrated and compiled that it is now within the reach of all; a few cents will place those most precious thoughts within the grasp of the student. Let us unite in our endeavor to educate our men in their profession; inducing them as far as practicable to read and think over the scientific literature flowing towards them. Animated with such knowledge coupled with their daily experience, the evolution of efficient service to our companies, must result and we and they will have an enduring place in the history of our progression.

Your committees have labored diligently with the work assigned to them at your last convention, and we bespeak for their reports your earnest attention, making special reference to the one on the compound locomotive.

We do not pretend to any knowledge in the untried future; we would not at all be understood as desiring to frown upon any advanced idea tending towards development and progress; we place an abiding trust in your intelligence and sagacity, and earnestly hope that you will devote such far-reaching inquiry and consideration to this subject as will enable you to successfully cope with the question in all its bearings, that all its salient points shall stand revealed; for which this association shall reap its full measure of honor and credit.

I should be derelict in my duty, ungrateful to this association, and untrue to myself did I not publicly refer to my election as your president one year ago, an honor ever to be remembered by me with the most affectionate gratitude. The cares and labors of an active life, in a rapidly developing section, with a fast growing business over both mountain and plain, have demanded such unceasing attention that I fear my share of your work has not received that constant activity that should been bestowed upon it; still I have faithfully endeavored to fulfill the trust you reposed in me. In all my correspondence with your committees and members I have received the heartiest co-operation, and I am especially indebted to our secretary for his valuable assistance.

To Mr. Sinclair, mechanical engineer, well versed in theory and experienced in practice, educated in his profession and cultured as a gentleman, at one time speaking to us as an editor through the medium of the art preservative of arts, and now as Secretary of this Association, I now openly tender my grateful thanks, and close my address invoking upon your labors in this convention the fostering care of Divine Providence.

ROLL CALL.

Secretary Sinclair called the roll. The following members were present then or at a later session.

Agnew, J. H., South Carolina, Charleston, S. C.
Ames, L., Beech Creek, Jersey Shore, Pa.
Barnett, Davis J., Grand Trunk, Stratford, Ont.
Barr, J. N. C. M. & St. P., Milwaukee, Wis.
Battye, John E., Shenandoah Valley, Milnes, Va.
Bean, John, C. & Canton, Canton, O.
Beckert, Andrew, Louisville & Nashville, Decatur, Ala.
Bisset, John, W. W. C. & A., Wilmington, N. C.
Black, John, Lima, O.
Blackwell, Chas., Shoenberger & Co., Pittsburgh, Pa.
Boatman, F. P., Ohio & Mississippi, Vincennes, Ind.
Bradley, S. D., G. R. & Ind., Grand Rapids, Mich.
Briggs, R. H., K., C., M. & B., Memphis, Tenn.
Bryant, J. T., Rich., Fred. & Potomac, Richmond, Va.
Bushnell, R. W., B., C. R & Northern, Cedar Rapids, Ia.
Campbell, John, Lehigh Valley, Delano, Pa.
Carson, M. T., Mobile & Ohio, Jackson, Tenn.
Casey, J. J., L., N. O. & Texas, Vicksburg, Miss.
Chapman, N. E., 251 S. Fourth street, Philadelphia, Pa.
Clark, David, Lehigh Valley, Hazelton, Pa.
Cook, John S., Georgia, Augusta, Ga.
Cory, C. H., C. H. & D., Lima, O.
Cromwell, A. J., Baltimore & Ohio, Baltimore, Md.
Deibert, F. W., C., J. & Mich., Marshall, Mich.
Divine, J. F., W. &. Weldon, Wilmington, N. C.
Downing, T., E., Jol. & Eastern, Joliet, Ill.
Ennis, W. C., N. Y. S. & W., Wortendyke, N. J.
Fenwick, A., G. B. W. & St. P., Green Bay, Wis.
Ferguson, G. A., Concord & Montreal, Lake Village, N. H.
Ferguson, Z. J.
Finlay, L., 902 West 4th street, Little Rock, Ark.
Foster, W. A., Fall Brook Coal Co., Corning, N. Y.
Fuller, Wm., 213 Kennard street, Cleveland, O
Garrett, H. D., Pennsylvania, Philadelphia, Pa.
Garstang, Wm., Ches. & Ohio, Richmond, Va.
Gentry, T. W., Richmond & Danville, Richmond, Va.
Gessler, Wm., C. R. I. & P., Trenton, Mo.
Gibbs, A. W., Richmond & Danville, Alexandria, Va.
Gibbs, George, C. M. & St. Paul, Milwaukee, Wis.
Haller, W. J., Ches. & Ohio, Richmond, Va.
Harding, B. R., R. G. R. & A., Raleigh, N. C.
Harris, Geo. D., Richmond & Danville, Salisbury, N. C.
Hazlehurst, G. B., Balt. & Ohio, Baltimore, Md.
Hassman, Wm., Ches. & Ohio, Huntington, W. Va.
Hemphill, W. J., Jacksonville South E., Jacksonville, Ill.
Hickey, John, M. W. S. & Western, Kaukauna, Wis.
Hudson, E. E., C. C. & St. Louis, Cleveland, O.
Hughes, E. W. M., Rookery Building, Chicago. Ill.
Jackson, O. H., O. & Miss., Vincennes, Ind.
Jennings, Wm., Mexican Intern'l, Piedras Negras, Mex.
Johann, Jacob, 608 Phenix Building, Chicago, Ill.
Johns, C. T., Cleveland, O.
Lannan, Wm., House of Represent's, Washington, D. C.
Leeds, Pulaski, Louisville & Nashville, Louisville, Ky.
Lewis, W. H., D., L. & Western, Kingsland, N. J.
Lewis, William H., C., B. & Northern, La Crosse Wis.
Losey, Jacob, Steam Forge Co., Louisville, Ky.
Luttgens, H. A., Rogers Loco. Wks.. Paterson, N. J.
Luttrell, J. W., N. N. & Miss. Valley, Paducah, Ky.
Mackenzie, Jno., N. Y. C. & St. L., Cleveland, O.
Maglenn, Jas., Carolina Central, Laurenburgh, N. C.
Manly Basil, A. & N. C., Newberne, N. C.
Marshall, E. S., St. L., A. & Tex., Pine Bluff, Ark.
McCreery, Frank, Dayton, Ft. Wayne & Chi., Dayton, O.
McCrum, J. S., K. C., Ft. S. & G., Kansas City, Mo.
McKenna, John, I. D. S., Indianapolis, Ind.
Medway, John, Fitchburg, Mechanicsville, N. Y.
Meehan, James, C. N. O. & T. P., Ludlow, Ky.
Michael, J. B., E. T. V. & Ga., Knoxville, Tenn.
Mills, Stott, Lehigh & Hudson, Warwick, N. Y.
Millen, Thomas, N. Y. City & N., Highbridge, N. Y.
Morrell, J. E., C., R. I. & P., Davenport, Ia.
Noble, L. C., H. & T. C., Houston, Tex.
O'Brien, John, Richmond & Petersburg, Manchester, Va.
Pattee, J. O., Great Northern, St. Paul, Minn.
Patterson, J. S., Col. & Hock. Val., Columbus, O.
Paxson, L. B., P. & Reading, Reading, Pa.
Pack, Peter H., C. & W. I. & Balt., Chicago, Ill.
Pitkin, A. J., Schenectady Loco. Wks., Schenectady, N. Y.
Porter, Joseph S., C. S. & C., Sandusky, O.
Purvis, Jr., T. B , Boston & Albany, East Albany, N. Y.
Quinn, John A., C. V. & C., Mt. Carmel, Ill.
Randolph, L. S., Balt. & Ohio, Baltimore, Md.
Raynal, A. H., Locomotive Wks., Richmond, Va.
Reynolds, W. W., C., St. L. & P., Columbus, O.
Richardson, E., S. & Allegheny, Shenango, Pa.
Riley, G. M. D., San., Fla. & Western, Savannah, Ga.
Roberts, E. M., E. T., V. & Ga., Atlanta, Ga.
Rutherford, Wm., Florida Southern, Palatka, Fla.
Savage, R. W., St. L., Ark. & Tex., Tyler, Tex.
Setchel, J. H., Cuba, N. Y.
Short, W. A., O. & L. C., Malone, N. Y.
Silvius, E. T., J. T. & K. W., Palatka, Fla.
Skinner, H. M. C., N. Y. Loco. Wks., Rome, N. Y.
Small, H. J., Southern Pacific, San Francisco, Cal.
Smith, W. T., New Port News, Miss. Val., Lexington, Ky.
Sprague, H. N., Porter Loco. Wks., Pittsburgh, Pa.
Stephens, S. A., Rhode Island Loc. Wks., Providence, R. I.
Stewart, O., Fitchburg, Charleston, Mass.
Stinard, F. A., 8 Dickinson St., Paterson, N. J.
Stone, W. A., L. E. & St. L., Huntingsburg, Ind.
Swanston, Wm., C. St. L. & P., Indianapolis, Ind.
Tandy, H., Brooks Loco. Works, Dunkirk, N. Y.
Thomas, C. F., Central Georgia, Macon, Ga.
Thomas, W. H., E. T. V. & Ga., Knoxville, Tenn.
Turner, Calvin G., Phil., & Wil. & Balt., Wilminton, Del.
Turner, L. H., Pitt. & L. Erie, Chartiers, Pa.
Turreff, W. F., C., C., C. & St. L., Indianapolis, Ind.
Ulmo, H. A., C. & Savannah, Savannah, Ga.
Walker, C. W., S. & Roanoke, Portsmouth, Va.
Warren, W. B., 2908 Lafayette Ave., St. Louis, Mo.
Weisgerber, E. L., B. & Ohio, Newark, O.
White, A. M., Schenectady Loco. Wks, Paterson, N. J.
Whitney, H. A., Intercolonial, Moncton, N. B.
Wightman, D. A., Pittsburgh Loco. Wks, Allegheny, Pa.

ASSOCIATE MEMBERS.

Barnes, D. L., Rookery Building, Chicago. Ill.
Forney, M. N., 145 Broadway, New York.
Hill, John A., 96 Fulton St., New York.
Pomeroy, L. R., Sub'n Rapid Transit Co., New York, N. Y.
Sinclair, Angus, Morse Building, New York.
Smith, John Y., Doyleston, Pa.
Smith, W. A., Rookery Building, Chicago, Ill.

BUSINESS REPORTS.

Secretary Sinclair then read his annual report. The first part of the report reads:

According to your secretary's report, submitted a year ago, this Association consisted of 297 ordinary members, 13 associates and 12 honorary members, a total of 322. The number of members on the roll at the opening of this convention is 334 ordinary members, 15 associates and 14 honorary members, a total of 563—making a gain during the year of 41 members. The increase is considerably greater than the figures represent, for 18 members were dropped for non-payment of dues, three resigned, and two ordinary and one honorary members have died. On the death roll are the names of H. N. Burford, J. M. Sanborn and H. M. Britton. The latter honorary member, who at the time of his death was general manager of an important railroad, was one of the organizers of the Association. He was for many years a hard worker in the interests of the organization, and was president for the longest time any one has held that office.

The treasurer's report and the report of the custodian of the Boston Fund were subsequently read, the former showing that the finances of the Association are in a satisfactory condition.

CHANGE IN CONSTITUTION.

Mr. J. H. Setchel, by unanimous consent, offered, according to notice given two years ago, the following resolution:

Resolved, That the words "without nomination" be inserted in article 7 of the constitution, after the words "shall be elected by ballot separately," and all other sections inconsistent therewith be and are hereby repealed.

Mr. M. N. Forney opposed the change. He advocated permitting new nominations to be made by any three members

Mr. Setchel held that nominations led to log rolling and that the sentiment of the members would be better expressed were no nominations made.

Mr. H. N. Sprague believed that balloting without nominations would lead to protracted delays in the election of officers. He favored a clause dropping all but the highest three after the first ballot.

On a vote being taken the resolution was adopted.

PROPOSED DISPOSITION OF THE BOSTON FUND.

Mr. Setchel offered the following:

Resolved, By the American Railway Master Mechanics' Association in convention assembled, that a committee of three members, consisting of J N. Lauder, John N. Barr and Angus Sinclair, be, and are hereby appointed, empowered and directed to confer with the trustees or other proper officers of the Massachusetts School of Technology, of Boston, the Cornell University, of Ithaca, N. Y., and the Stevens' Institute of Technology, of Hoboken, N. J., to arrange and report a plan to our next annual meeting for the investment of the principal and interest of the Boston Fund of this Association in one or more scholarships in one or all of these institutions and submit the same for the approval of the Association. The benefits of said scholarships to be for such time as may de directed by the Association as a prize to the sons of members who shall exhibit the most valuable attainments and skill in the development of locomotive mechanics.

And be it further resolved; That notice is hereby given that a vote will be taken at our 24th annual meeting to so appropriate said fund.

The resolution was seconded by Mr. Johann.

Mr. Setchel: All the resolution carries is the appointment of a committee to make arrangements to carry out the ideas and to report at our next annual meeting.

On a rising vote the motion was carried unanimously.

METHODS OF FITTING BOLTS.

President Briggs announced that the noon hour had arrived, and the order of business became the discussion of current subjects. Secretary Sinclair intimated that the first subject handed in was The Best Method of Fitting Bolts, by Mr. James Meehan.

Mr. Meehan described the old method of fitting bolts, where the weight of the hammer used in driving it home had an important part to do with the fit. They introduced the practice of fitting all their bolts to templates, and it resulted in great saving of time and labor. Their bolts are made with a taper of one-sixteenth inch to the foot.

Mr. Sprague uses steel dies for fitting bolts in. Uses straight bolts except in rods. He does not pretend to duplicate a driving fit. Bolts that are too loose for a driving fit are used as loose bolts. He is not able to prevent reamers from wearing, and therefore there is difficulty in getting the bolts made in stock that will be a driving fit.

Mr. A. J. Pitkin uses cast iron gauges and bolts are all fitted to these. The holes in the work are reamed, and the bolts driven without any fitting. Use scarcely any straight holes.

Mr. H. J. Small: Our practice on the Pacific coast is to use tapered fits. We follow the practice that is almost universal in railroad repair shops, of reaming the hole and then fitting the bolt to it.

Mr. Pulaski Leeds wanted to know how many used straight bolts for straight holes. Had always feared that there was a slight taper to them almost universally. For many years had taken every bolt from blacksmith's shop; turned it down to the size of the thread. When such a bolt is thread-

ed and driven into a hole the fit is invariably on the thread and the bolt soon becomes loose. Our practice now is to take a finishing cut over the bolt, giving it a slight taper and fitting it to a ring gauge. A great many of our bolts are through wrought iron and cast iron. Any reamer I ever saw will ream larger in cast iron after passing through wrought iron. We drive our bolts through wrought iron first and then into the cast iron. I taper bolts, and I adopted the same thing with crank pins. I always found that a crank pin unless fitted on a taper had the bearing on the point inside of the wheel where it did no good, and on the outside the pin would always be loose. Believed that bolts can be made by gauges to fit, if the gauges are properly adjusted to the reamers. He reduces his reamers to exact graduations where they begin to get worn. Has very little trouble with loose bolts.

Mr. H. A. Luttgens said they tapered plugs fitted into tapered holes as a basis for reproduction of sizes.

Mr. J. S. McCrum asked Mr. Leeds at what pressure a crank pin for a consolidation engine was put in. The answer was, nothing less than 65 tons and nothing more than 80.

Mr. William Swanston believed in tapered bolts, and was perfectly satisfied that a true fit could not be secured with a straight bolt. They use the plug and hollow reamer and drop the reamer in a certain distance, and with the taper a sure fit is secured.

Mr. McCrum held that the tightness of a parallel bolt would depend on the character of the hole it was driven into. If the surface of the hole was smooth the bolt would be a better fit than where the surface of the hole was rough with loose metal that would easily be displaced.

Discussion closed.

SAFETY OF THE PONY TRUCK.

Secretary Sinclair intimated that the next subject was by Mr. Forney: "Is it safe to run a pony truck under the front end of fast express engines?"

Mr. Forney—I find now on different roads that they are building heavy ten-wheel engines and mogul engines for running express trains. Some time ago I was making a design for a locomotive and it would have been much more convenient to have used a pony truck. Some parties objected to a pony truck as being unsafe at high speed. It is true that moguls with pony trucks in front are used generally for freight purposes. But those engines must run at a high rate of speed and if there is any danger it should show in freight service as in passenger service.

Mr. W. J. Hemphill gave experience with moguls, and considered they were perfectly safe at the highest speeds.

Mr. E. M. Roberts favored the use of moguls, and never knew of any trouble with the pony truck. There is every argument in favor of this design; the distribution of wheel base is better for carrying the weight. Take 100,000 pounds on your drivers and substract 14,000 pounds and you have an available weight on your drivers of 86,000 pounds. To the ten-wheeled engine with your other truck you would need to have 112,000 pounds to get a weight on the drivers of 78,000 pounds. It is claimed the flange wear is the same; that, perhaps, is true. The flange wear on a front pair of drivers in some instances is a little more than on a ten-wheeler.

A member had had a great deal of experience with mogul engines, and never had any trouble with the pony truck, except that there was considerable flange wear. It is very important that the pony truck be properly built.

Mr. McCrum believed that the character of the road had a great deal to do with the relative success of mogul and ten-wheel engines. He believed that on a road with sharp curves the increase of friction due to the longer rigid wheel base of a mogul would overcome any advantages that might be gained by the increased weight on drivers.

Mr. Setchel had an indefinite idea that the mogul was not so safe to run at high speed as the ten-wheel engine, and therefore he preferred the latter. It is true that no records are extant showing that moguls are more liable to jump the track than ten-wheelers, but he believed had moguls been run at high speeds on the inferior track common a few years ago that bad accidents would have occurred. Believed it the duty of railroad men to take all possible precautions against accidents in the running of fast passenger trains.

Mr. L. R. Pomeroy asked if excessive flange wear of the mogul pony truck was not due to defect of the radius bar.

Mr. Setchel answered that excessive wear of any truck is due to some mechanical imperfection.

Mr. John Mackenzie considered the mogul all right if the rigid wheel base was not made too long. He would not hesitate to run moguls at any speed, but there is difficulty in getting them into some sidings. There was no such difficulty with ten-wheelers. Had concluded that it would be better to shorten the rigid wheel base of moguls. When that did not exceed 14 feet the engines worked satisfactorily. Mentioned cases where the rigid wheel base was extended to 16 feet the engines did not run more than 20,000 miles before they had to be stopped for cut front driving wheel flanges.

Mr. Charles Blackwell mentioned that the Chicago, Burlington & Quincy had been running moguls on fast passenger trains with success.

Mr. Forney reminded the meeting that the question under discussion was, is the pony truck safe at high speeds? Not the relative merits of mogul and ten-wheel engines.

Mr. Sprague said that they had built many engines with pony trucks during the narrow gauge craze that were intended for running at high speed, and he never heard any question about their safety. They had much experience with engines having back trucks, and he never heard of their going off the track.

Mr. L. Finley had charge of engines with pony trucks running on a road having prevailing curves of 16 degrees. Found no difficulty in running them without accident.

Mr. J. N. Barr considered there were other questions that are nearly as important as safety in deciding whether pony or four-wheel trucks should be used.

Mr. D. L. Barnes said that the Chicago, Burlington & Quincy have been, for two years past, using moguls for passenger service. There has never been an accident to that engine caused by the truck leaving the track. The truck has left the track in sidings, the result of the method of hanging the truck. They have adopted the pony truck on Forney suburban engines, and they are run at a high rate of speed safely. The Illinois Central use a pony truck under their suburban engines, and they work satisfactorily.

Mr. Mackenzie asked if any one in the room had ever heard of a pony truck leaving the track at high speed?

Secretary Sinclair answered that he had known two cases where accidents happened with pony trucks jumping the track, but the trouble was the result of faulty design. He considered most of the opposition to the pony truck arose from sentimental prejudice. Did not see that a well designed pony truck was radically different from the pair of carrying wheels used under English locomotives and no one had ever questioned the safety of that arrangement.

The noon hour having expired Mr. Forney proposed that the discussion be continued next day.

Mr. Leeds urged that the subject be extended to embrace the utility of using moguls and ten-wheel locomotives. After some discussion this was agreed to. When the subject was called up the next day

Mr. John Campbell said that he had 20 years of experience with the pony truck and never knew of an accident with it; but for fast passenger service he would prefer a four-wheel truck, as there was less vibration when it was used.

Mr. P. H. Peck had been in charge of mogul's for six years and he had no hesitation in putting mogul engines on any train. Considered a pony truck perfectly safe for any kind of service.

Mr. Roberts believed that there was a prejudice against the pony truck without cause. An important feature in favor of the mogul in his eyes, was that the valve gear could be arranged without bends in the eccentric rods or intermediate connections.

M. Albert Griggs has had Moguls in use for 19 years, and he found no difficulty about their curving, no matter where they were put. He used them on very crooked tracks and found that the mileage made by the pony truck wheels was equal to that made by the front wheels of four-wheel engine trucks.

Mr. Leeds has got hundreds of consolidation and mogul engines running with the pony truck, and he is not afraid to run them at any speed. The necessities of modern passenger service that demands very heavy boilers had induced him to recommend ten-wheelers for new passenger engines they have ordered. For a passenger engine with cylinders 18x24 inches he preferred an eight-wheeler; for a passenger engine, cylinders 19 inches in diameter or over, with the heavy boiler necessary for providing steam, he preferred a ten-wheeler because the four-wheel truck could be made to carry the extra weight that would be excessive for three pairs of drivers. It is a case where the four-wheel truck provides the means of making the best possible distribution of the weight.

Mr. Cromwell said that on the Baltimore & Ohio they have 200 consolidation engines. The engines of this type first used had a bald tire in front, and they gave trouble by leaving the track on short curves. Tired wheels were then put in front and there was no more difficulty, although the flanges wear rather rapidly. Have to be very careful in the construction of pony trucks as very little deviation in the length of the links will make the engine run to one side.

Mr. Setchel: There is a belief among car builders that the six-wheel truck is safer than the four-wheel truck. Why? Because there is more surface to distribute the wear over. Believed the same reasoning applied to locomotives, and that the apparent safety of moguls was owing to the superior condition of modern tracks.

Mr. J. N. Barr mentioned a case within his experience where a switchman found a piece of flange about 15 inches long in a frog. One of the principal passenger trains had passed out, and in telegraphing ahead notice of the broken flange the engineer discovered it belonged to one of the engine truck wheels. The train had gone 12 miles safely with the broken flange. Now, the question was, how would the pony truck act under a similar accident?

Mr. Mackenzie: Was induced to use ten-wheel engines on account of the point brought out by Mr. Leeds. He wanted a larger boiler, and found that a better distribution of the increased weight could be obtained by putting a four-wheel truck in front.

Mr. McCrum had adopted the ten-wheel engine because he thought it the most economical to use, and years of experience had made him perfectly satisfied with his choice.

After a little more discussion the subject was closed.

CONFERENCE COMMITTEE.

Mr. J. H. Setchel moved for the appointment of a committee to confer with a committee appointed by the Master Car Builders' Association on the means of bringing the conventions of the two associations closer together in relation to the time and place of meeting. Messrs. O. Stewart, Chas. Graham, David Clark, G. W. Stevens and John Mackenzie were appointed on this committee.

APPLICATIONS FOR ASSOCIATE MEMBERSHIP.

Applications for associate membership were received from John R. Lecksley, A. T. Woods, W. D. Crosman and W. H. Marshall.

The following committee was appointed to report on the applications: H. N. Sprague, Charles Blackwell and James Meehan. This committee reported that it was desirable applications for associate membership should lie over for a year, and notice was given of a proposed change in the constitution to require that. The applications were held over for action at next convention.

After some more routine business had been dispatched Mr. J. Davis Barnett read the report of the committee on

COMPOUND LOCOMOTIVES.

The slight experience America has had with the compound locomotive, although elsewhere there are between six and seven hundred in successful service, so contracts the possible field to be covered by a report on the subject assigned to us, that we, of necessity, must go beyond the limits of this land and of this Association for the major part of our facts; and in expressing opinions and conclusions, are compelled to take for granted a fair acquaintance with its modern literature, giving the experimental results of trials carried on outside the American continent.

To commence with—and as a help in the direction of narrowing the province to be covered by this report—we would suggest for discussion the following questions, viz.: 1st. Is increase of boiler pressure an essential element in the success of compounding? 2d. What gains have followed compounding? 3d. What are said to be its losses? 4th. What, per engine, is the increased first cost of compounding? and 5th. Does the saving more than balance this cost? 6th. What are American conditions for locomotive service, and can the compound locomotive meet them? 7th. Is it an essential defect of the compound that it must be short of starting power? 8th. Give a brief summary covering some details and peculiarities common to compounds.

1st. IS COMPOUNDING OF ANY VALUE WITHOUT INCREASE OF BOILER PRESSURE? This query is due to the repeated assertion that in compounding there was not, and could not be, an economy in steam consumption, except the boiler pressure be decidedly increased, raised to 170 pounds., or even higher. The results of the experiments of Mr. T. Urquhart, locomotive superintendent G. & T. Railway (Southeast Russia), contradict this statement. The trials cover a period of ten months, in the same class of service, with simple and compound engines practically of the same weight, and all with pressures of 135 pounds, and they show for the compounds a general average saving in fuel of 18 per cent.

Apart from this solution of the vexed question of pressure, Mr. Urquhart's experience is unusually interesting, because the experiments were carried out in cold weather, with oil fuel, which has a more uniform heating quality than soft coal; and the delivery of the fuel into the fire box was almost automatic, thus practically getting rid of the "personal factor," for which it is always necessary to allow in comparing special and brief experiments.

Mr. C. Sandiford, of the N. W. Railway, Lahore, India, reports a 13½ per cent. economy with unaltered, but still lower, pressures, viz., 120 pounds, the saving being the same whether the steam was used in two or four cylinder (tandem) engines.

These results will not surprise those who are familiar with exactly parallel cases in other forms of steam engineering.

Do not misunderstand us to say that there are no economies in higher pressures. There are wide possibilities with high temperature; and the many published figures, from recent trials, stoutly confirm our opinion. But under this leading heading, the committee wished to emphasize the fact that compounding, at ordinary working pressures, has its own value as an economizer of steam, without keeping hid the sister fact that higher pressures give an additional possibility. And it should not be forgotten that very high pressure steam has, so far, only been fully utilized by passage through more than one cylinder.

Higher pressures and very early valve cut-offs, for simple engines, have had a fair trial on many of our railroads; nevertheless, to-day initial cylinder pressures above 150 pounds are rare; and we believe that when boiler pressures higher than 160 pounds are retained, it is with the object of making the boiler a reservoir of power for starting and grade climbing, rather than with a confirmed faith that very early cut-offs lower the fuel bill.

The Saxony Railroad report increasing their boiler pressures for simple engines from 8½ to 12 atmospheres (say from 120 to 175 pounds), without resultant economy; whereas 212 pounds has not proved too high for convenience or economy in the compound practice of the P. L. & M. Railway (France).

2d. WHAT GAINS HAVE FOLLOWED COMPOUNDING? (*a*) It has achieved a saving in the fuel burnt averaging 18 per cent. at reasonable boiler pressures, with encouraging possibilities of further improvement in pressure and in fuel and water economy. (*b*) It has lessened the amount of water (dead weight) to be hauled, so that (*c*) the tender and its load are materially reduced in weight. (*d*) It has increased the possibilities of speed far beyond 60 miles per hour, without unduly straining the motion, frames, axles, or axle boxes of the engine. (*e*) It has increased the haulage power at full speed, or, in other words, has increased the continuous H. P. developed, per given weight of engine and boiler. (*f*) In some classes has increased the starting power. (*g*) It has materially lessened the slide valve friction per H. P. developed. (*h*) It has equalized or distributed the turning force on the crank pin, over a longer portion of its path, which, of course, tends to lengthen the repair life of the engine. (*i*) In the two-cylinder type it has decreased the oil consumption, and has even done so in the Woolfe four cylinder engine. (*j*) Its smoother and steadier draught on the fire is favorable to the combustion of all kinds of soft coal; and the sparks thrown being smaller and less in number, it lessens the risk to property from destruction by fire. (*k*) These advantages and economies are gained without having to *improve* the man handling the engine, less being left to his discretion (or careless indifference) than in the simple engine. (*l*) Valve motion of every locomotive type can be used in its best working and most effective position. (*m*) A wider elasticity in locomotive design is permitted; as, if desired, side rods can be dispensed with, or articulated engines of 100 tons weight, with independent trucks, used for sharp curves on mountain service, as suggested by Mallet and Brunner. One such engine of 80 long tons is now under construction.

3d. WHAT LOSSES ARE SAID TO HAVE FOLLOWED COMPOUNDING? (*a*) In some particular types, as actually proportioned, a loss in starting power of from 15 to 20 per cent. However, loss of power in starting cannot be said to be a defect in the principle of compounding. (*b*) An increase in the number of parts. They are few and plain in the two-cylinder engine, entailing little outlay in first cost or in repair. (*c*) A possible, but, this committee thinks, not probable increase in the cost of repairs to the boiler, per pound of fuel burnt, if higher pressures are used. Positive information on this point is difficult to obtain. (*d*) An increased cost of repairs to the engine per mile run. This item is not yet large enough to be measureable after three years' continuous service in the plainer forms of the two-cylinder compounds. (*e*) A larger percentage of failures on the road due to greater complication and size of parts. (*f*) Increased reciprocating weights on one side, either not balanced, and so increasing the deflection of the engine, or, if approximately balanced, the balance weight doing injury to the road bed, etc. The two last sections seem to be pure suppositions, which, after search, we find no evidence to sustain. (*g*) Want of variability or adaptability to wide extremes in speed, and to amount of work to be performed; so that a large compound does not work as cheaply when hauling light loads, or running without load, as a single engine does.

It is not proved that a compound, working properly throttled, that is, with steam wire-drawn, may not have actually, as she theoretically has, a wide and economical adaptability. So that if the compound, like any other motor, be not as economical when exerting low power as when exerting full power, it probably will use less steam than the simple engine of the same weight, working under similar conditions of light haulage duty.

However, the one thing certain about "American conditions" is that no large portion of our motive power does run lightly loaded, and until we have a wider experimental experience, it is not recommended that all locomotives, doing branch and local light service, be built compound.

4th. WHAT IS THE INCREASED FIRST COST PER ENGINE? M. V. Borries has published figures giving cost. In speaking of his own design of engine, he says they can "be built two to five per cent. cheaper than single engines of the same power—not of the same maximum tractive force; because this power depends upon the boiler, which might be 10 to 15

per cent. smaller for the compound engine. If the same boiler is kept, as is commonly the case, the compound engine would be some 2 or 3 per cent. heavier and 4 or 5 per cent. more costly than a simple one; but, with properly dimensioned cylinders, 10 to 15 per cent. more powerful than the latter. For equal work the compound engine would always be the cheaper engine." Mr. E. Worthington says: "The intercepting valve and copper pipes forming the receiver, and the patterns for two different sizes of cylinders, are the chief items which raise the cost of a two-cylindered compound locomotive; while engines with three or more cylinders have additional parts, which considerably increase their cost. In engines with four cylinders, the tandem system is cheaper than the receiver system. Tandem cylinders, are, however, objectionable, because the pistons are difficult to examine; but the receiver system is ready of access, and affords an opportunity of heating the intermediate steam by calculating it among the waste gases of the smoke-box; and, by isolating the high-pressure and low-pressure cylinders, an advantageous difference of temperature is maintained between them."

"The cost of constructing a number of two-cylindered locomotives does not greatly exceed that of the same number of ordinary engines. The cost of three-cylinder locomotives may exceed that of simple engines by $1,000 to $1,250 each."

The cost of changing simple to two-cylinder engines need not exceed $250 to $300 each, if the expense of drawings, patterns, and templates be divided over a series of engines. The additional cost of building a two-cylinder engine, with receiver, etc., as used by the Michigan Central Railway, or the ingenious form of four-cylinder engine, as used by the Baltimore & Ohio Railroad, need be little, if anything, over $200 (excluding royalties), or say from two to two and a quarter per cent. increase on the cost of a simple engine.

5th. DOES THE SAVING MORE THAN BALANCE THE INCREASED FIRST COST? If, for convenience, the fuel saving be taken at 17 per cent., or one-sixth, and the gross consumption at 900 tons per year, with coal at $1.50 per ton, the decrease in the annual fuel bill is but $225. Certainly not a wide margin to cover contingencies. If, however, at first only the more powerful engines are compounded, whose consumption averages 1,200 tons per year, and coal, as is common, costs on tender $3 per ton, the saving on fuel is $600, or two cents per mile on a mileage of 30,000 per annum. As this amount would cover not only reasonable interest on first cost but also allow for about 33 per cent. increase in total expenditure for motive power, repairs and renewals, the saving is certainly enough to permit a possible, but, we think, not a probable, largely increased cost of engine repairs, and yet have a margin of saving on the final balance sheet to the credit of the compound.

6th. WHAT ARE "AMERICAN CONDITIONS" FOR LOCOMOTIVE SERVICE? CAN THE COMPOUND ENGINE MEET THEM? We have given this section a large amount of attention, because it has so often been said that the compound must, to be successful on this continent, be adapted to suit American conditions, and your committee naturally were desirous of fully understanding these conditions. They have not been specified by those making the assertion, and we must reluctantly confess to having failed to identify, much less define, them, so that, after a long, unsatisfactory chase, they appear to us to be somewhat mythical. If any member can, and will, specify them he will confer a favor, at least upon the committee, if not upon the association.

If an American condition be large starting power, then the Mallet two-cylinder and all four-cylinder engines easily have cylinder power in excess of their adhesive weight. If American conditions be ability to do satisfactory work on a second-rate or third-rate roadbed, or simplicity of construction, or easy accessibility of parts, then these conditions are met by any two-cylinder engine, or by the Baltimore & Ohio Railroad four-cylinder engine.

Apparently neither climate nor men are factors in this equation, as compounds are a success in the hands of ordinary enginemen in partially civilized countries; and in hot climates, as well as in Russia, under conditions of low temperature and snow as trying as those ordinarily met with inside of 51 degrees, the present northern limit of our railway belt.

7th. IS IT AN ESSENTIAL DEFECT OF COMPOUND LOCOMOTIVES THAT THEY MUST BE SHORT OF STARTING POWER? Certainly not! The starting power of the Mallet type is at least equal to that of a simple engine of the same weight, and its cylinder power can easily be made to exceed it, by allowing more than half boiler pressure in the large cylinder for the first few revolutions. In the V. Borries, Worsdell, Pitkin and other two cylinder types, and the Lepage three-cylinder engine, their starting power (as Prof. Woods has graphically illustrated), at 170 lbs., may be greater than that of a simple engine at 150 lbs., having cylinders of the same size as the high pressure, *during the first half revolution*, but that after this the power (at low speed) of the compound diminishes to 80 or 85 per cent. of that of the simple engine. This conclusion is modified and improved by the knowledge that all two cylinder engines originally designed as compounds have, or should have, their small cylinder larger than the cylinder of the simple engine of corresponding weight or duty.

It is possible, with the Lindner or equivalent form of starting valve—and a painstaking engineman—to get about 90 per cent. of the starting power of a corresponding simple engine. The Webb type of three-cylinder engine (except with the low-pressure crank dead on center) has cylinder power enough to slip both pairs of wheels, and no higher starting power is desirable. What may be called the opposite form of three-cylinder engine (the Sauvage type), with cylinders of approximately the same diameter, as used on the Northern Railway of France, has ample starting power, because the full boiler pressure is admitted direct to the two low-pressure cylinders. In fact, if desired, the locomotive can be continuously so worked, viz., as a simple engine. Tandem and other forms of four-cylinder engines are not wanting in starting power. The B. & O. Railway engine in starting, with a gear as simple as the water-tap gear, puts the small piston practically into equilibrium, and thus admits high-pressure steam to the large cylinder.

A mean effective pressure of 90 pounds, in a simple 18 × 24 inch engine, will start a train of 13 coaches on a level in a lively fashion, and a compound can easily give the equivalent of that total pressure without being over-cylindered.

Going back to the two-cylinder style of engine, with automatic intercepting valve, and limited size of cylinder, it would seem as if all of them were capable of getting into motion the load they were designed to haul at full speed, so that their limitations are that they do not get away quite as smartly, quite as noisily, or with the same tearing effort on fire and fire-box as do certain simple engines that waste both fuel and steam in starting. The comparative difference, in time or distance, required by this class of compound to attain maximum speed has not yet been shown by experiment, but is probably less than is generally supposed.

Mr. Urquhart, desiring to settle the question of the tractive power of simple engines altered to compound, with one cylinder unchanged, and with boiler pressure unchanged, carried out tests, using both indicator and dynamometer; and he reports that at a speed of 10 miles per hour the compound passenger engine suffered the following diminution, viz.: in first notch, 42 per cent.; in second notch, 28 per cent.; in third notch, 7 per cent.; in fourth notch, 7 per cent.; and in fifth notch, or full gear, 5 per cent. And a similar test of the freight compound showed, in the first notch, 27 per cent. loss; in the second notch, 17 per cent.; in the third notch, 10 per cent. and in the fourth notch, or full gear, 5 per cent. He goes on to say that, for all practical purposes, in full gear a ve per cent. difference, at this speed, may be neglected.

8th. GENERAL.—A recent press notice credits Mr. Webb with an attempt to reduce first cost by throwing away the valve gear for the low-pressure cylinder and using in its place a single loose reversing eccentric—in other words, with an attempt to use an invariable cut-off for the large cylinder. And such practice is not unreasonable, if it from the first be acknowledged that the compound is designed for doing a maximum specific duty with high economy, and, therefore, the valve gear cannot be, and is not, arranged for a wide variability of service.

This intention in design most clearly marks all those engines using but one valve, or one valve stem, to distribute the steam to both high and low-pressure cylinders; such, for instance, as the Vauclain piston valve, the Woolfe hollow D valve and the Dunbar single valve stem. In the first two mentioned most ingenious valves, the release of the high-pressure cylinder must be at the same moment as the admission to the low pressure, or it is no actual release, and the cut-off in the low-pressure cylinder marks the exact point when compression in the high-pressure cylinder commences, there being no appreciable "receiver" capacity in the valves themselves, large as the passages through them have to be. There is, then, it is clear, little elasticity of adjustment in such valves and gears. The cut-off being early in the small cylinder, it must be early in the large, and as a result the compression in the small cylinder is enormous. Thus the conclusion is again brought home to us that the control of the compound, when small horse power is to be developed, must be chiefly through the throttle wire-drawing in the stem, and thus reducing the initial pressure.

Putting emphasis on this truth will not frighten those who are familiar with the fact that wire-drawing is common today with our best enginemen. And it may here be noted that the *imperative necessity* for this so-called "crude practice" is the full explanation for the slight use in modern locomotives of screw and other finely divided reversing gears. This statement opens up the whole matter of cylinder condensation, but it is too large a matter to be properly treated in this report.

However, such modern experimenters as Westinghouse, Kennedy, etc., prove that wire-drawing the admission into cylinders of large surface and small volume is more economical than valve cut-offs at less than 50 per cent. of the stroke.

There are some constructive details and peculiarities about compounds that may deserve special mention. For instance, it is judicious to put safety or relief valves on the low-pressure chest or cylinder, but they should be so located or guarded that in case they came into action they should not smother the engineman with steam and obscure his vision. All types do not require water-taps on both cylinders, but most receivers should be so drained. If an intercepting valve is used a reducing valve is not required, and if an intercepting valve is not used there must be a valve to give independent exhaust direct to the atmosphere from the high-pressure cylinder. The weight of evidence, so far, is in favor of the use of an intermediate receiver. Such a device effectually isolates the cylinders, so that each retains its distinctive temperature. The general practice of drying the intermediate steam by putting the receiver in the smoke-box has much to recommend it. Copper pipes, set close to the curve of the smoke-box, are not cumbersome, or much in the way; and if it be desired that the feed water also be heated in the smoke-box, the large receiver pipes need not interfere with the details of such an arrangement. Receiver capacity cannot, under our limiting conditions, be too large. It should never be less than 1½ times the volume of the high-pressure cylinder, and two or more volumes are desirable; because, with a liberal receiver, the steam supply to the low-pressure cylinder is more uniform in pressure and amount, the reheating or drying of the steam is more thoroughly done, and "the drop" in pressure between high-pressure final and low-pressure initial is less detrimental to steam economy.

If one side of a compound should break down the other side can be run as a single cylinder engine, if the failure is not due to a total collapse of the cylinder on the side to be blocked. And in a tandem, as in a simple engine, the failure on one side may be a total collapse, without its interfering with the use of the other side as a single engine.

J. DAVIS BARNETT,
JOHN PLAYER,
H. D. GARRETT,
F. W. DEAN.

Mr. J. Davis Barnett explained that the committee made it their business to find out what number of compound locomotives were running on this continent, and they were so few that it was decided not to issue a circular of inquiry on the subject. Under these circumstances they had to depend for information on what was done with compound locomotives in other countries. Held that general engineering practice had shown compounding to be economical without increase of boiler pressure. Increase of boiler pressure without compounding had led to very little economy of fuel. Saw no reason why compounding, which had been successful in other departments of engineering, should not be a success on wheels.

Secretary Sinclair announced that Professor A. T. Woods, an eminent engineer who had devoted much attention to the subject of compound locomotives, was present, and moved that he be permitted to address the convention.

Professor Woods: Had watched with great care the growth into favor of the compound locomotive, and he had not learned of any but one decided failure of that type of engine. That was on the Boston & Albany. Many of the arguments that are current against compound locomotives were used for years in opposition to compound marine engines. Thinks the mechanical features, which are often introduced in discussing compound locomotives, form a separate question. If you have a compound engine and get greater expansion from the steam with such a point of cut off in the cylinders that you have a better distribution and reduce your condensation you must get economical results. By what form of engine, two, three or four cylinders, this result is obtained is largely a matter of individual preference. You would naturally prefer the simplest form. The compound locomotive is not as flexible as the simple engine. To get the most economical results the engine should be designed for the work it is to do.

Mr. A. J. Pitkin had examined the blue prints of the Boston & Albany compound locomotive, and had reason for believing that the trouble with the engine was in defects of design. The steam passages were entirely too small for the cylinders. Believes thoroughly in the two-cylinder type as the proper form of compounding, and that there would have been great economy in that engine had she been properly designed.

Mr. G. B. Hazlehurst: In answer to a question about the compound built by the Baldwin people for the Baltimore & Ohio, said that the engine is still in the hands of the builders, and that all data about her performance are in their possession.

Mr. Meehan said there was in the meeting the copy of a very interesting letter sent by Mr. Leeds to Mr. J. G. Metcalf, general manager of the Louisville & Nashville, on compound locomotives, and he moved that the secretary be instructed to read it.

Secretary Sinclair read the letter, the salient parts of which were:

I would not at present recommend such purchase, my reasons being that the compound locomotive has not yet been perfected to its possibilities; nor do I believe that it will ever do all that is claimed for it. At the same time there are enough ready to build and try these engines which will develop the defects, as well as demonstrate their value. This will give later entries in the field points to design from more intelligently. While the compound principle has proven a full success as applied to condensing engines, we are trying to obtain the same results under altogether different conditions; first, in the condensing engine they are enabled, by using different areas, to expand a high-pressure steam down to a point where it is practicable to condense it economically; that is, without overloading the air pump, thereby getting the full benefit of expansion, besides getting a larger area of piston for the vacuum to work on. In this way they get the benefit of high pressure expanded to the utmost, and the same result from vacuum as they would on a single cylinder of the same diameter as their largest and stroke enough to contain the value of both, or three if triple, besides less loss from radiation and consequent condensation of their live steam. The differences in conditions are, that we have to maintain a back pressure of about 16 pounds, for the purpose of exhaust to fan our fires, but the principal thing to be decided is the proportions of ratio of cylinders.

Mr. Leeds then proceeds at some length to discuss the compound principle of using steam and the measure of economy likely to result therefrom. That part concludes:

Right here comes in the question of true economy, varying as the comparative cost of fuel and repairs vary. If the cost of repairs is increased by the extra sizes, especially weights, of reciprocating parts, which have in turn to be counterbalanced, then the economy is reduced in just that degree, and, as repairs do not vary in cost per mile run in the same degree as coal does in different parts of the country, what might be a great economy at one point would only just balance in another.

You will notice that in all reports so far made there is nothing definite given. The Webb engine, imported from England, has developed about the same power, after starting, as one of our 17-in. engines of the seventy type, but you would not tolerate her one trip on account of not starting with more than about four cars. The Lake Shore report says she did good work with some degree of economy with freight, but when put on passenger they had to cut her valves, thus lessening her power for the sake of speed. Another thing, this report only covers five cars on a level road at 50 miles per hour. My deductions, after years of observation and study on this point, that there is a combination of points in compounding (of which the higher pressure is not the least) making it possible to do the same work with about 15 per cent. less fuel; that at least one-half of this is lost in repairs, where fuel and repairs to mile run are nearly equal. That when such men as compose the Western Railway Club, while acknowledging their belief in compounding, declare that they do not know why there should be or is any such economy; then there is nothing for it but to experiment and observe the results of different proportions and design.

Mr. Angus Sinclair, Editor of the NATIONAL CAR AND LOCOMOTIVE BUILDER, is a man with whom I discuss all such matters more than any other. Before he went to Europe he was a strong advocate of compounding; after his return, I quote: "It is an open question, there being the most violent conflict of opinion on the subject among locomotive superintendents in Europe, where they ought to know all the comparative values. A month spent in the home of the compound locomotive took away a great deal of the faith previously held in that type of engine."

I have not heard of any of these gentlemen who have ordered compounds advancing any novelties in their construction, and the only thing they gain in owning them is that they can observe at home what all of us can get the data of from others, their actual gain or our loss being but a very small amount in dollars and cents, which we can well afford to lose for one year, if at the end the engine is better proportioned for adoption.

P. LEEDS, S. M.

Secretary Sinclair had been a great believer in the simple locomotive, but facts which could not be controverted had convinced him that the compound locomotive was economically a success. When in Europe he heard so little favorable to the compound locomotive in places where they ought to have been most conversant with its value, that he returned feeling that it was not the success its friends represented. Afterwards he had some experience with the Michigan compound, and although he went with some prejudice against the principle, to watch the working of that engine, he became convinced that the engine was economically and mechanically a success. It was not pleasant to make public confession of mistakes, but he would rather acknowledge a mistake than hold blindly to a prejudice.

Mr. H. J. Small had come East expecting to obtain some exact and reliable information about compound locomotives, but found facts to be somewhat scarce. Their fuel was very expensive, and he wanted to know if compounds could be used successfully on grades of 174 feet to the mile. Was anxious to find a builder who would guarantee a compound locomotive to work as well as a simple engine and more economically.

Mr. Barnett said he understood that Mr. Dunbar, designer of the Boston & Albany compound, was absent when the engine was built and tried. We are all aware of the difference it makes when the inventor of a new machine is not there to watch the shortcomings apt to develop on the first trial. Believed had Mr. Dunbar been overlooking his engine he would have made it a success.

The Baltimore & Ohio compound is experimental and there are many details to be changed, but he felt assured that it would eventually be made a success. Did not think that the increased boiler pressures had any material influence in making the compound more economical than the simple engine. The working of the Worsdell compounds had proved beyond question that the cost of repairs for a well built compound locomotive is not high.

Mr. Pitkin, in answer to a question said that the Michigan Central compound was rather quicker in starting a train than a simple engine, which he attributed to the great cylinder power. He could not see that the maintaining of extra parts could cost much as the only additional part of that engine was the intercepting valve, which had not been touched since the engine went into service six months ago. The saving of fuel with this engine was from 20 to 25 per cent. Thought there was more room for compound locomo-

tives in this country than there was abroad owing to the excessively hard duty of our engines. Held that a compound used steam with smaller change of cylinder temperature than a simple engine, that consequently there was less condensation. Did not think there was economy in cutting off shorter than 50 per cent. of the stroke with compounds running at high speed. Discussion closed.

After a variety of routine business had been disposed of Secretary Sinclair read the report of the Committee on the

EFFICIENCY OF THE LINK AS COMPARED WITH OTHER VALVE MOTIONS.

This report described a variety of valve motions that had been designed for the purpose of producing a better distribution of steam than that given by the link motion. Among the motions described are the Morton patent valve gear, the Clark independent cut-off, the Uhry & Luttgen's improved link motion, the Wilson valve gear, the Stevens valve motion and the Woolf valve gear. The report concludes:

Nowhere is the "survival of the fittest" more pronounced than in railroad practice. The history of valve motion and devices to improve the link motion, and those that were to supersede it (?) would fill volumes. Many have been theoretically correct, and very promising, but, after the crucial test, have resulted in failure; and the link motion remains in almost undisputed possession of the field.

It has been urged against the link that it is not a scientific or true mechanical motion. This may be true, but the fact remains, that fairly good results are obtained from it; that it will take more punishment in the shape of rough usage and neglect, and cost less to make and repair, than any other valve motion now being experimented with on locomotive engines.

Your committee are led to believe that valve motions other than the link are experimental, owing to the difficulty of ascertaining data of the results obtained from them, excepting the "Stevens" motion, of which Mr. Small has sent full report.

The almighty dollar is always to the front, and no matter how theoretically correct a motion may be, unless it costs less in every way than the link, it will not displace it. It frequently happens that the poor results obtained from a locomotive are charged to the valve motion, when the cause may be found in contracted steam passage pipes, leaky valves or pistons, steam wire drawn through the throttle, and back pressure, caused by contracted exhaust nozzles. It is surprising what a change will be made in the back pressure line of an indicator card by slightly increasing or diminishing the open in the exhaust nozzle.

In conclusion, your committee are of the opinion that there has not been brought to their notice a valve motion more efficient for all-round work, and general utility, than a well designed link with large bearing surfaces---assisted in its work by steam passages and pipes of generous dimensions ---free from sharp turns and bends---giving the link plenty and hot steam to distribute; and, most important of all, not crippled at the very end by a contracted exhaust nozzle.

JAMES M. BOON,
DAVID CLARK,
H. TANDY,
} Committee.

Mr. Luttgens explained that with his motion described in the report, the motion is precisely the same at 6-inch cut-off as an ordinary link motion at 11 inches. Discussion closed.

Next report was read by the secretary on the advantages and disadvantages of

PLACING THE FIRE-BOXES ABOVE THE FRAMES.

This report dilated at considerable length on the necessity for providing a boiler that would freely generate all the steam required by the cylinders. To do this properly for the handling of modern trains at prevailing high speeds while using the inferior fuel supplied, the claim was made that a boiler ought to have at least 2,800 square feet of heating surface.

We are troubled, continues the report, for steam, and to meet this emergency many plans and ideas have been suggested, and still we find that we cannot get where we wish to be. In marine and stationary boilers, the rate of combustion is cut down as low as possible, say fifteen pounds per square foot of grate per hour; but in the locomotive we try to burn as much fuel as possible per square foot of grate, and this runs up to 150 pounds, and often more. Thus we see that the locomotive is forced away beyond the economical limit, and cannot be compared with the two classes of boilers named above for the economical use of fuel. Modern passenger locomotives are usually built with frames 43 inches apart. Then, allowing for wedges and clearances, we have 41½ in. outside of boiler, and 34⅛ in. width of fire-box. When placed between the axles, the length is then limited to six feet, eight inches, about, according to the style of the engine. Now we take the same engine and cut off the frame, and make a splice in frame back of main pedestal jaw, dropping it about 7 in. The rear part of frame is depressed so as to permit the boiler to hang as low as in the previous instance. It will be observed that the distance from bottom of mud ring to centre of bottom row of tubes, is 25⅜ in. in both examples. The water bars have a pitch of 1 in. to the foot, which insures free circulation of the water. A slight offset is made sideways in the frames, just back of the splice, so that the frames back of that point are 42 in. apart. The fire-box is also 42 inches wide, the frames being 50 inches outside. The object in thus narrowing up the frames is to make room for the equalizing beams, which, through the alterations already made, have to be placed between driving wheels and frames. In this boiler we have 31.5 square feet of grate surface instead of 25.59 square feet. All things considered, we gain about 23.1 per cent. by placing the furnace over the frames. The driving boxes can by this arrangement be made to cover longer journals, thus increasing their durability and reducing the probability of overheating.

The idea of lengthening out a fire-box beyond certain limits in order to secure a larger grate area is objectionable, unless a brick arch in the furnace be used to deflect the gases backward, so as to better utilize all of the heating surface of the crown sheet. Without such an arch, the gases, in rising from the surface of the fire, are compelled to assume the form of an hour glass in order to squeeze through the tubes. We are fully convinced, therefore, that it is better to place the fire-box on top of the frames, and gain the desired grate surface by increased width rather than by length. This style of furnace is being received more favorably every day, and the prejudices that used to appear against it are not heard so frequently. Some of the more conservative of our railroad officials have adopted this method of attaining the desired object. The depth of furnace at the front end is an essential matter, and we find that where the distance from top of grates is less than 20 in. the lower tubes are invariably stopped up by fuel being drawn into them; and we have seen fire banked up in such a fire-box so as to cover five of six rows of tubes. We advocate not less than 20 in., and more when it can possibly be had. The argument which we so often hear against the wide fire-box, that it necessitates the hanging of the engine from the bottom, has no weight, because it is well known that an engine hung from the under side of the driving boxes rides very much easier than the one with springs on top of the frame. We know where this change has been made, and the engine ran very much easier afterward; besides, the springs and equalizers are in this case more easily handled than when hung from the top. The cost of spring rigging, all things considered, is no more in the former case than in the latter. It is well known that raising the boiler so slightly as is required does no harm, but is rather a benefit, because every one who has ridden on a Wootten locomotive could not help observing the ease with which it passed around curves. When an engine leaves the track, one design is about as likely to roll over as the other, or at all events we never knew them to stand upon ceremony. It is also urged that, with the fire-box above the frame, the mud ring can not be caulked. If the mud ring is properly put in, there will be no need of caulking, for your committee have tried the plan on several locomotives during the past year, upon the Buffalo division of the Delaware, Lackawanna & Western Railroad. The mud ring is made thick at the corners, so as to put in a double row of rivets. No leaks have as yet occurred with mud rings applied in this manner. The water used in these boilers is probably as bad as any in this country, for it is impregnated with sulphuric acid, and forms a hard scale, principally of sulphate of lime. A question may be suggested in reference to double riveting all round, but that involves the subject of boiler construction, with which this committee has nothing to do at present. The spring rigging on this engine is easily reached, and it is found that, with the centre of gravity high, the lateral motion does not so readily appear, and that the wear and tear of the running gear is under those conditions very much less than when the boiler is set low in the frame. With single riveted mud rings, these engines gave no end of trouble, but with the double riveted corners they do not leak, or, in other words, the disease in this case is cured by the remedy described.

In summing up, the evidences prove that with the fire-box above the frames the combustion is very much better than when between the frames; the larger nozzles may be used, thereby lessening the objectionable back pressure upon the exhaust. Cheaper fuel may be used, other things being equal. More water space around the fire box may be had, and the sides of the furnace may be inclined sufficiently to take advantage not only of a greater efficiency of the heating surface, but giving the water a better chance to circulate. We also have more space for the ash pan, and can hang it higher to keep it out of the snow and away from the driving boxes. The rigid wheel base can be shortened. It gives better clearance for eccentrics and straps. It makes a better proportioned boiler, when found necessary to increase the diameter of boiler shell or to lengthen the fire-box. The fireman can work his fire to better advantage, and the weight of engine can be more evenly distributed upon the wheels. The cost of keeping up the expansion braces is very much less, and the frames can be taken down and replaced at a very much less expense of time and money, than with the furnace between the frames. Soft coal as well as anthracite is now being used in fire boxes above the frames. In classes D and H the mud rings are level, while in class I there is a straight incline toward the front end, having a drop of 7⅝ in. in a length of 6 ft. One reason for dropping the frame in this instance was on account of the short fire box, so as not to cover the front of the grate with a pier to support the brick arch, and also to secure a good depth of fire between the grate and brick arch. In classes I and D the tubes are 2 in. in diameter, while in class H they are 2¼. This road uses brick arch with fire boxes above the frames, and advocates its use generally in this style of boiler.

We find through close observation that, on account of the peculiar formation of the boiler, owing to the curved sheets forming the front of the furnace, and the leg of the boiler, where the heat is most intense, the expansion and contraction of those sheets is necessarily greater at that location than at any other part of the boiler. Consequently in a short time the sheets begin to work loose from the mud ring at the corners, more especially if the water be bad, and difficult leaks occur. With good water we find no such objection. We recommend double riveting at the corners at least, and that cast-iron grates be used in preference to water bars. We like the brick arch and believe in its economy, but there are many practical objections to it. That however, is a subject somewhat foreign to the one in hand, so we recommend that the association discuss its merits independently. The disadvantages of placing the fire-box over the frames are, in our opinion, so small that we do not like trespassing upon your valuable time in attempting to discuss them.

From the meagre information received, and the entire absence of data relating to the actual performance of locomotives with fire-boxes above the frames, and from the fact that the replies to our circular contain no comparisons of the relative economy between locomotives with the fire-box between the frames and those having the furnaces over the frames, your committee do not feel satisfied in this attempt to do the subject justice. Our report is therefore very incomplete. These replies have been very slow in coming in, so that after considering those communications, the time at the disposal of the committee was too limited to permit any experiments, which would have enabled us to determine certain supposed advantages of the wide fire-box. Furthermore, from information received from various builders of locomotives, there will probably be put to work within the next few months at least 300 to 400 locomotives with fire-boxes above the frames, from which reliable data can be taken. This should be done and embodied in a subsequent report. We suggest that this subject be continued, in order to permit of the collection of such data, and to make suitable experiments to decide the questions proposed.

FRED. B. GRIFFITH.
JAS. MACBETH.
W. A. FOSTER.
LEWIS F. LYNE.

This committee was continued, and no discussion followed the reading of the report.

Next business was the reading by Mr. John Mackenzie of the report on

RELATIVE VALUE OF STEEL AND IRON AXLES.

This report consisted mostly of extracts from answers to a circular calling for information about the relative value of iron and steel axles from those who had experience in the use of both. The report concludes:

From the reports received your committee is unable to make any recommendations as to the value of steel as compared with iron. The members seem to have lost sight of the main question—*i.e.*, safe limit of diameter of driving axles, as called for by the circular.

We therefore suggest that the whole matter be referred to another committee, and that that committee shall ask for new diameters of all new axles and for the weights as given in the circular, and also the safe limit of diameter, the same to be given in the reduction of diameter, and also on the mileage basis. Steel and iron to be given separately.

JOHN MACKENZIE,
J. S. GRAHAM,
JOHN S. COOK.

Secretary Sinclair regretted that the committee had not been able to collect more information on this subject, which he regarded as being of great importance. The price of steel is now very little different from the cost of iron, and there are many master mechanics who would specify steel for axles if they were perfectly satisfied that the material was entirely satisfactory for the purpose. Called on those present who had used steel axles to tell what their experience had been.

Mr. Geo. Gibbs: We have tried in the last few years several sets of steel axles, and the results have not been satisfactory. Our experience with crank pins, driving axles and car wheels is that steel heats more and wears more rapidly than iron. From our present standpoint we are decidedly in favor of sticking to iron for axles and crank pins.

Mr. Swanston: We are using steel exclusively for axles, and believe we get better results than with iron. The price of the two materials is nearly the same, and steel appears to be more nearly uniform in quality. The homogenity of the steel produces a better journal that is more exempt from seams than iron. Believed that greater mileage was got out of iron than out of steel axles.

Mr. McCrum had encountered trouble in getting thoroughly solid iron for axles, and that had induced him to try steel. Now have about 40 locomotives equipped with steel axles. The wear of the journals is not satisfactory, and he had never found a steel journal that would take on the burnished surface common with iron. But, on the whole, he was decidedly in favor of steel for axles.

Mr. Mackenzie wished to have the Committee on the Best Material for Axles continued, and he appealed for the sending of more information by members to committees.

Discussion closed, and subject continued.

The next report was read by Mr. C. F. Thomas, on

EXHAUST PIPES, NOZZLES AND STEAM PASSAGES.

Your committee on the subject of steam pipes, passages and exhaust nozzles, beg leave to report that during the past two years the individual members of the committee have made a number of experiments with a view of finding some foundation to start from on which to determine the size of exhaust nozzles in proportion to other parts of the engine or boiler.

The conditions that must be fulfilled by a successful and desirable nozzle are:

That it must create draft enough on the fire to make steam, and at the same time impose the least possible amount of work on the pistons in the shape of back pressure.

It should be large enough to produce a nearly uniform blast without lifting or tearing the fire, and be economical in its use of fuel.

After two years of experiment and research your committee has come to the conclusion that owing to the great diversity in the relative proportions of the cylinders and boilers, together with the difference in the quality of the fuel, that any rule which does not recognize each and all of these factors would be utterly worthless.

The quality of fuel is one of the most important factors, and must be recognized.

The diameter of the cylinder cannot be taken and the stroke and other proportions ignored.

The size of stack alone, without taking into consideration the size of cylinder, grate and flue area is manifestly at fault.

The principal question on which the exhaust nozzle practice of the country splits is whether the pipe shall be double or single.

Those using the double pipe claim that in this way only can the exhaust from one cylinder be prevented from adding injurious back pressure on the other, while the advocates of the single nozzle urge that the use of two exits requires that neither of them shall be central, and consequently the exhaust will not produce the maximum effect, while the single exit, being in the axis of the stack, will produce the maximum effect, and can, in consequence, be made larger and reduce the necessary back pressure.

Your committe regard neither of these opinions as correct without some qualification. We have found that there is very little difference in the back pressure in either plan, and this is entirely a question of design. So true is this that it is impossible to determine, from the card alone, which type of nozzle is used.

Your committee is also of the opinion that the use of the single exit does not insure concentricity of the exhaust steam with stack, and that in very many of the single pipes the steam is not discharged even approximately central.

The greatest part of the experimenting of the committee has been with single pipes, with a view of embodying the results in future engines ordered by their roads. The questions which were to be determined were the total heights of the pipes and the height of the bridge, relative to that of the pipe. Also the relation of the area of each exit at meeting point to the final exit. The first of these questions we have not determined. Starting with the idea that in order to reduce the effect of the exhaust of one cylinder upon the other, the bridge must be carried nearly to the top of pipe, we have found that the height had no perceptible effect in this direction, but the greater the height relative to that of the pipe, the greater was the difficulty in preventing the discharge from crossing in the stack.

Acting on this, your committee has in some instances reduced the height of bridge to much less than half that of pipe; with no increase of back pressure. Your committee is of the opinion that the most vital point in the design is that the area of each of the two pipes where they combine shall in no case exceed that of the final exit, and the indications so far are that this area can, with advantage, be made decidedly less than the final one; how much less we do not know.

Your committee, while aware that in addition to the types of nozzle mentioned there are various annular ones as well as those in which the discharge is spread after leaving pipe, but as yet we have not been able to test their merits as compared with plain pipes, except in the case of the Smith triple expansion pipes, on which experiments are now being made, and so far we have found that this pipe allows the engines to steam freely with a very large final opening, and we are in receipt of several communications from those using them, in which considerable fuel economy is reported.

Your committee would also state that the use of a large final exit relative to that of piston does not of itself imply low back pressure. They have more than once been misled by making this assumption without checking it by use of indicator.

Your committee submits drawing of one of the pipes which they consider has given good results, together with several cards from the engines using it. From these the members can judge how results compare with those obtained on their own roads.

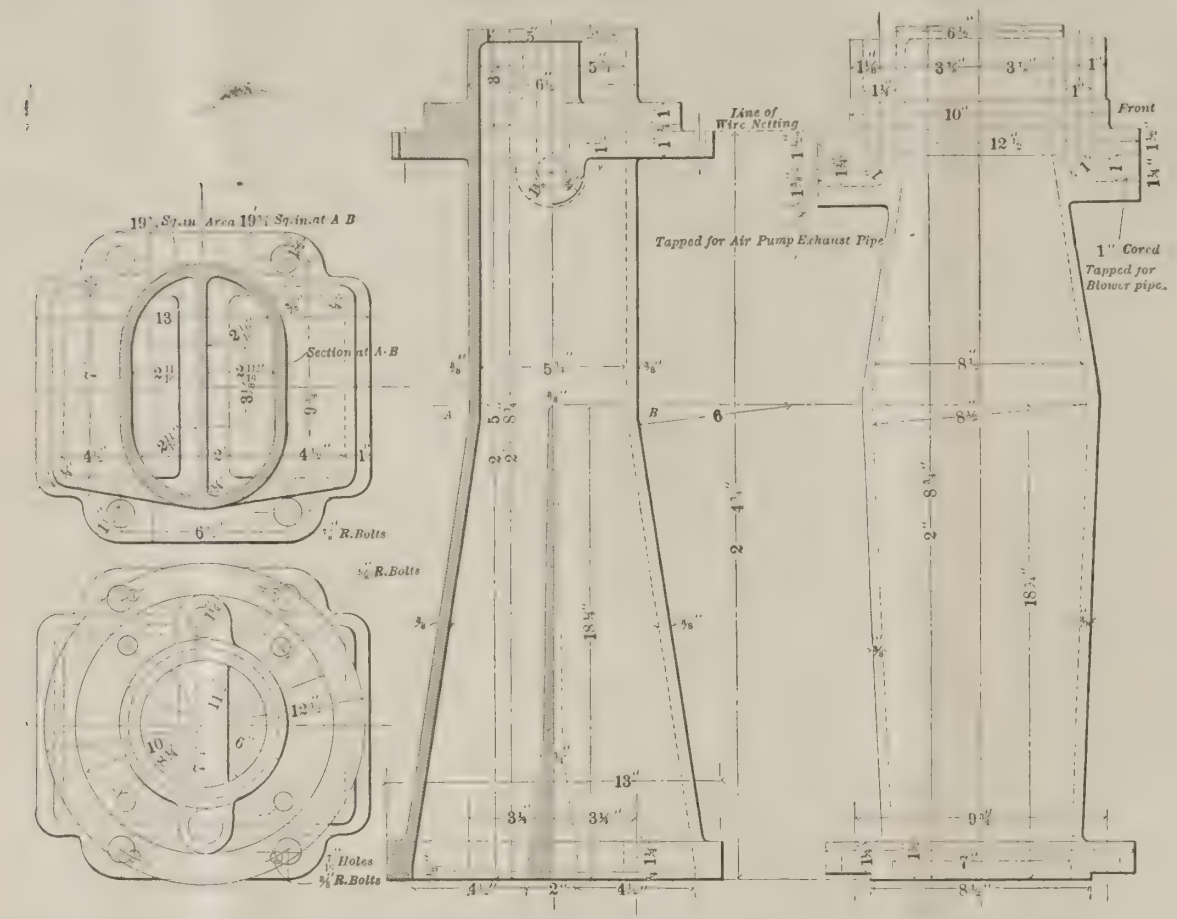
In view of these facts, your committee feels itself incompetent to advise any plan to determine the size of exhaust nozzle in proportion to any other part of the engine or boiler, and believes that the best possible practice is for each user of locomotives to adopt a nozzle that will make steam freely and fill the other condition named, best determined by an intelligent use of the indicator and a check on the fuel account.

C. F. THOMAS,
A. W. GIBBS,
J. A. HILL.

A letter was also read from Mr. C. Blackwell, saying, that

on a recent trip he had made it a point to inquire of every master mechanic his practice in regard to smoke stacks and exhaust pipes. What was reported as giving entire satisfaction upon one road would be found in the scrap heap of another. Varying circumstances require alterations in the combinations.

Mr. A. W. Gibbs: One set of men are trying to get as uniform a blast as possible without regard to back pressure. Another set are trying to get rid of the steam as quickly as possible, but trying to prevent the exhaust from one cylinder affecting the other. This has led to a great variety of pipes. The kind of coal used has a great influence on the success of



EXHAUST NOZZLE AND PIPE.
[*Referred to in Report on Exhaust Pipes.*]

an exhaust pipe. It is impracticable to discuss the exhaust pipe by itself. The variations in stacks and other conditions make all the difference in the world.

Mr. L. S. Randolph thought it would be very satisfactory if we could get the relation between the form of stack, the size of nozzle and its position to the amount of vaccum obtained. We want to get the best possible vacuum with the least amount of back pressure.

Mr. Roberts: It seems to me that the stack area, arrangement of diaphragms and draft appliances and the exhaust nozzles should go together.

Mr. George Gibbs thoroughly appreciated the difficulties encountered by the committee. The elements are very complicated and the form of nozzle is only one. Smoke-box area, diameter of stack, nature of cone and one hundred and one other conditions come in. For a particular class of engines we tested, we easily obtained the vacuums for different kinds of nozzles. We also determined for one particular nozzle, that a certain vacuum produced a certain result. A certain amount of vacuum would pull the fire through the flues, but we were totally unable from that to draw a conclusion as to the size of nozzle suited to slightly different conditions.

Mr. A. W. Gibbs told that the committee had got up apparatus that would enable them to take indicator diagrams from cylinders and smoke box simultaneously.

Secretary Sinclair considered that the committee had brought in a very valuable report representing a great deal of private investigation on a difficult subject. Moved that the committee be continued and enlarged. Carried.

Next report was on

BRICK ARCHES IN LOCOMOTIVE FIRE-BOXES.

The committee on this subject reported as follows: A circular was sent out and 31 replies received, showing that 24 roads used the arch, 14 of whom used circulating pipes, and 10 used studs, angle iron, or a combination of both to support it, and seven did not use the brick arch in any form; three of the latter used anthracite coal for fuel, one used wood, one had tried the arch and discarded it; no reason given; the remaining two had never used it.

Actual tests, extending through long periods, show most conclusively that the brick arch may be used with a short front and diamond stack, with excellent results and great economy, when bituminous coal is used. But very few replies to our circular give positive data, from which even an average per cent. of the saving of fuel could be shown. Some of the replies say the saving is from 25 to 40 per cent. This assertion is backed by the unanimous opinion of all those using them. The same can be said of its efficiency in decreasing the number of live sparks thrown from the stack. We find no evidence that one well constructed and properly applied has any seriously damaging effect on the sheets of the fire-box or boiler tubes.

The average brick arch supported on circulating pipes costs about $30 in place in the fire-box. The addition of extension front averages about $100. The items of stack and cast front end proper, with door, are not included in the cost of the arch and extension as given here, as these would have to be used under any circumstances. The arch complete on circulating pipes is applied by some roads for from $17 to $20, while others who are equally as well equipped to do the work, say it costs them from $35 to $45. We also find the same difference in cost of applying extension front in various shops.

The information gathered by your committee shows conclusively that the first cost of the arch, supported on circular pipes in a safe and substantial manner, is about twice that of most of those supported by angle irons, protected studs, etc., and these latter devices, if properly protected by allowing the bricks to cover the supports, last longer than the best applications of the former, and the danger attending a bursting pipe is dispensed with. Those using circulating pipes for supporting the arch claim they are best, and say they have in most cases tried other plans and gone back to the pipes. Others who formerly used pipes have abandoned them for angle iron, and still others with studs protected by a pipe drilled to shield them and the whole somewhat covered by the brick arch.

There are many points in favor of abandoning the circulating pipes if other satisfactory supports can be arranged. First, the circulating pipe support is attended with more danger from their liability to become clogged or burning thin and bursting, or from blowing out of sheets and scalding firemen or others, even where rigid inspection is made at regular periods. Second, the pipes are more costly to apply and difficult to adjust to position, and, in order to secure a safe and tight fit, great care must be taken in cutting and tapping holes and threading the pipe, sleeve, nut, etc., and in the few instances where arch pipes are put in and expanded in position, thinner tubes must be used and very large holes bored in the sheets opposite the ends of the tubes, all of which are somewhat objectionable. Third, the pipes are generally more or less in the way of working on the boiler tubes, particularly where more than three pipes are used, and if only these pipes are used, broken bricks cannot be utilized, which is one of the best features of the pipe support.

The good points of the pipe support are: First, as a rule, a simpler and consequently cheaper style of brick can be used. Second, if four pipes are used, nearly all broken bricks can be utilized, and to those familiar with the shipment of carload lots of ordinary arch bricks, this is a big item. Third, if, as claimed by many, the brick injures the side sheets when allowed to rest close and hard against it, the pipes will admit of a suitable space being left at the ends of the bricks without impairing the rigidity of their support. Fourth, when shops are well equipped and have a good system, the circulating pipe support can be put in for much less than it is costing most of our roads at present.

The cost of maintaining the brick arch and extension front is much less than the cost of keeping fire-tight and spark-proof any form of diamond stack. The comparatively gentle suction of the high nozzle of the extension is ample to clear the tubes and deposit the sparks in the front, but does not cut away the heavy steel wire netting below the nozzles. The sparks in the one instance are caught and driven before the exhaust steam and along with it, while in the other they are sucked or pulled after the successive exhausts, and the sand blast effect is destroyed.

In conclusion your committee find that the brick arch greatly assists in bringing about more perfect combustion . . . and we, therefore, recommend its use for bituminous coal.

We recommend as the best manner of supporting the arch that method known as the angle iron and stud supports, and we believe that the best features of some of these might be combined and worked into a support that will meet the requirements of the general service. We are not prepared to recommend the abolition of the circulating pipe, but we suggest the serious consideration of a safer and cheaper method for supporting brick arches than is obtained by their use.

We desire to call attention to the large number of arch bricks broken in transit and by handling after they are received. This is especially the case where bricks are hauled long distances and when shapes are flat, long and heavy. Some suitable means should be adopted to strengthen the brick by having iron rods made up in the moulds in such manner that should the bricks become cracked or broken through their section, they would be held together and could be utilized. As soon as exposed to heat in the furnace, they would fuse together from the effect of accumulated slag, etc.

T. W. Gentry,
Allen Cooke,
L. C. Noble,
W. A. Smith, } Committee.

This report was discussed at considerable length by Messrs. Setchel, McCrum, Hickey, Lewis, Meehan, Griggs, Hatswell, Stewart, Gentry, Barnes and Swanston. The claim was made that the brick arch was capable of securing a fuel economy varying from 15 to 30 per cent. Great diversity of opinion was expressed about the value of circulating pipes for supporting the arch, the consensus of opinion being against their use.

Next report was on

PRESERVING LOCOMOTIVE TANKS FROM CORROSION.

The committee having the subject in charge found from the information received, in answer to a circular, that the most successful methods of preventing corrosion of water tank sheets was the keeping of the sheets clean and well painted.

The conclusions arrived at are that several coats of a superior metallic paint, allowed to become thoroughly dry and hardened before the tank is put to use, would prevent a great deal of this corrosion. Sloping the top sheets of the tank toward the center of the coal pit prevents the standing of water on those sheets, but the fact remains that the moistened coal mixing with the cinders from the smoke stack will cause a certain amount of corrosion.

One member of this Association suggests that the side sheets of the coal pit be constructed of corrugated brass, the corrugation to stiffen the sheets, making it possible to use a lighter gauge. The high first cost would be an objection to this. A large amount of corrosion could be prevented by the men running the engines. It is the practice on some of the railroads to completely drench the coal with water, in order to lay the dust. When this is found necessary water should be used with moderation.

W. J. Robertson,
Albert Griggs,
O. Stewart,
Jerome Wheelock, } Committee.

No discussion followed the reading of this report. The next business was the reading of the report on

THE BEST FORM AND SIZE OF AXLES FOR HEAVY TENDERS.

Your committee, to whom the subject of "The Best Form and Size of Axles for Heavy Tenders" was referred, prepared the following circular and sent it to the members of the Association and others:

1. Are you in favor of an axle for heavy tenders with or without end collars?

Ans. .....

2. If in favor of an axle with end collar please give figures for the following dimensions:

(A) Diameter of end collar.....in.
(B) Diameter of journal.....in.
(C) Diameter of dust guard seat.....in.
(D) Diameter of wheel seat.....in.
(E) Diameter centre of axle.....in.
(F) Length of end collar.....in.
(G) Length of journal.....in.
(H) Length of dust guard seat.....in.
(I) Length of wheel seat.....in.
(J) Length from center to center journal.....ft.....in.
(K) Length of axle over all.....ft.....in.

3. If in favor of a collarless axle, please give the dimensions as above, except the (A) and (F). Also kind of end stop and manner of fixing same.

.....

4. Which one of the three forms in use (given below) of form of axle between the wheels do you approve? And why?

.....

5. What is the limit of weight on journals per square inch of contact?

.....

By a heavy tender your committee understands one that, when loaded will carry, say about 3,600 gallons of water and about 16,000 pounds of coal.

To this circular your committee have received 36 answers, and of these 17 express in favor of the master car builders' standard axle for cars of 60,000 pounds capacity, as adopted last year; ten are in favor of the same general form of axle with slight changes in the dimensions, but no two of these ten agree; three favor the M. C. B. axle for 40,000 pounds capacity cars. Thus we have 30 replies in favor of axles without collars. Of the dimensions given by those in favor of the collarless axle, no two are agreed, nor do they agree in regard to the end stop, as each has a different design.

There are twenty answers to the questions of limit of weight per square inch of contact, and these vary from 170 pounds to 350 pounds, showing a wide diversity of opinion, and that the question was not viewed from the same standpoint by those making the answers.

Your committee would recommend 300 pounds as a safe standard for limit of weight per square inch of contact, and recommend that this contact be equal to the diameter of the journal. With the journal 4¼ inches by 8 inches the weight per square inch of contact with a tender of the dimensions in our circular, would be about 225 pounds per square inch; this would vary, according to the construction, but there would be ample margin for safety and good results as to wear.

To the question as to the form of axle between the wheels there are 13 for form No. 1; two for form No. 2, and 13 for form No. 3, making 28 answers to this question. Your committee are of the opinion, however, that form No. 1 is the correct one. The question of form between wheels was suggested at the time the circular was under consideration, by one of the members of your committee having several bent and broken axles of forms Nos. 2 and 3 in his shop. Since then we found that the Pennsylvania Railroad had noted on their blue prints the adoption of form No. 1, and your committee asked from Mr. A. S. Vogt, mechanical engineer, Altoona, and from Mr. Edward Grafstrom, chief draughtsman of the P., C. & St. L., and C., St. L. & P., Pennsylvania lines west of Pittsburgh, the reason which led to the change and attach thei answers as part of our report.

Your committe would then recommend the adoption of the master car builders' axle for cars of 60,000 pounds capacity, with form No. 1 between the wheels as the proper dimensions and form for an axle for heavy tenders.

This will also be in the interest of economy, as the car and tender axle of heavy capacity will be interchangeable and no special axle for this purpose will have to be carried in stock.

W. Swanston,
W. Garstang,
Jas. Maglenn,
L. R. Pomeroy, } Committee.

The following are the letters referred to in the report. Mr. A. S. Vogt writes:

"There has from time to time been much complaint about axles used by the Pennsylvania Railroad Company being weak, and we have a few of the large size with 4×8 inches journals broken in service. This break has generally taken place, especially in the iron axles, half way between the center of the axle and the inside hub of the wheel; this is also a favorite place for the axle to bend. Some time over a year ago, we made a very thorough investigation of the dimensions required for car truck axles, taking into consideration not only the static loads, but also the shocks against the flanges of the wheels caused by the striking of curves and points of the frogs in yards, also allowing for the forces acting in a horizontal direction through the center of gravity of the car, all of which make it necessary to make the large diameter of the axle directly at the inner end of the wheel fit, but the same investigation also shows that the axle can be gradually diminished in diameter toward the center; this reduction in size proceeds in a way which causes the outline of the axle to assume a curve, resembling a very flat parabola. The trouble has been with our axles in the past that they did not receive any mathematical investigation, but were simply guessed at, and although the shape approached a true one, it was not quite right; this curve was the principal error, and investigation showed that it should be a great deal flatter than we had it; in fact, so much so, that it is nearly a straight line, and we made it so. That part of the axle, therefore, resembles two truncated cones joined at the small end.

"I think you will also find that a shape proposed by the master car builders as their standard for the 60,000 lbs. cars is the same shape, and this form of axle is shown on

plate No. 8, and described on page No. 211 of the master car builders' report of 1889."

Mr. Edward Grafstrom writes:

CALCULATION OF CAR AXLES.

"Referring to your inquiry, why the first form of axle shown on your circular is the most correct, I would give you the following graphic demonstration:

"*A D* is the center line of the axle (see diagram No. 1), and *S* is assumed to be the center of gravity of the car. If the car weighs 80,000 pounds loaded, each axle would support a weight of 20,000 pounds, represented in the diagram by *Q*. Beside this weight, each axle is acted upon by a horizontal

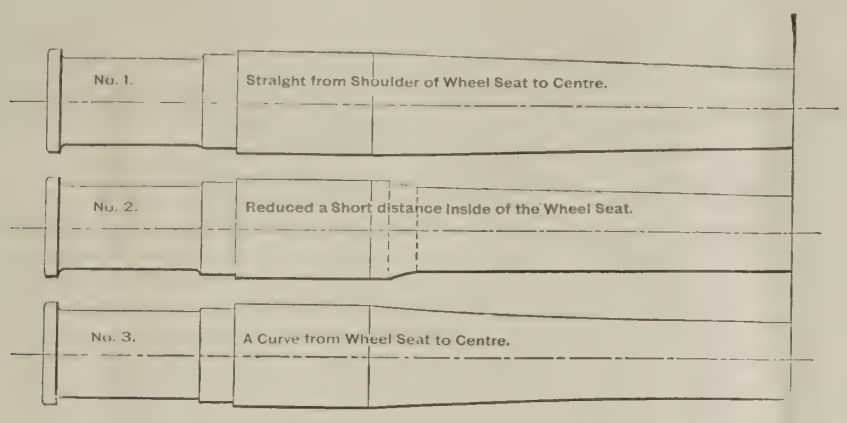

No. 1.
Straight from Shoulder of Wheel Seat to Centre.
No. 2.
Reduced a Short distance Inside of the Wheel Seat.
No. 3.
A Curve from Wheel Seat to Centre.

Diagram No. 1.

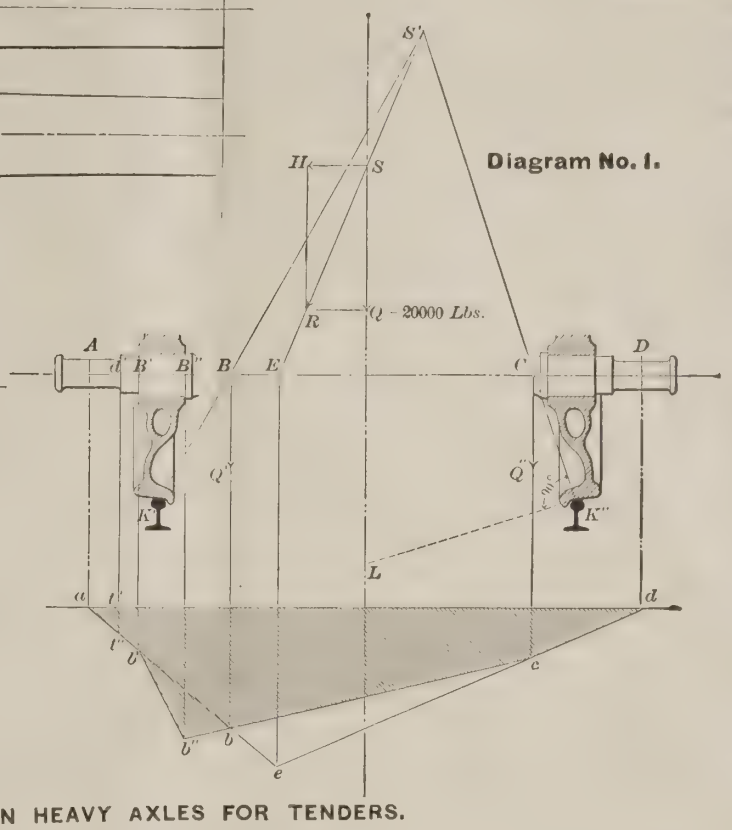
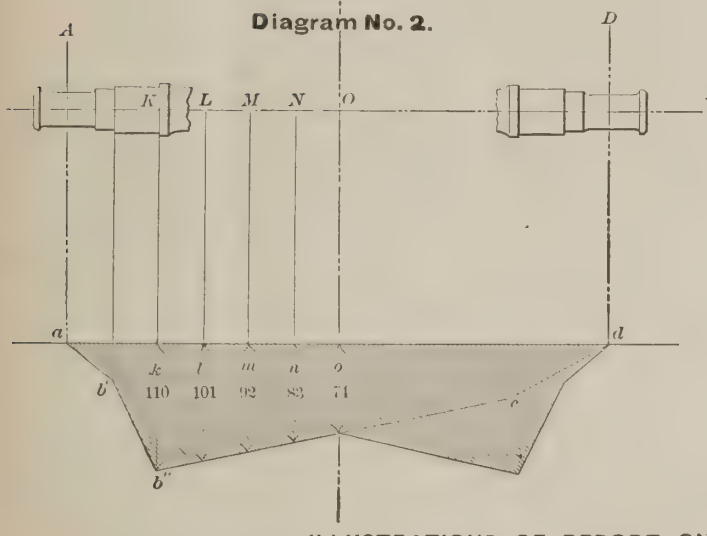


Diagram No. 2.



ILLUSTRATIONS OF REPORT ON HEAVY AXLES FOR TENDERS.

force *H*, caused by the centrifugal force in curves and by the swinging motion of the car. This force *H* has by Adam Scheffler's experiments at Braunschweig, Germany, been found to be as high as 0.4 of the load. The resultant of the force *H* and the weight *Q* is represented by the line and direction *R*.

"If *R* is divided into components going through the rail heads, it is apparent that the component through the rail *K''* from which *H* is turned must be normal to the surface of the rail in contact with the wheel, or, in other words, the force of *R* must be moved upward in its own direction until the angle *S' K'' L* is equal to 90 degrees. The two components of *R* would then act along the lines *S' K'* and *S' K''*. These lines intersect the center line of the axle at *B* and *C*, and here are divided into vertical components *Q'* and *Q''*. besides horizontal components, which may be left out of consideration, as they do not affect the axle.

"From the point *E*, where *R* extended intersects the center line of the axle, a vertical line *E e* is dropped to some point *e* below a line *a d*, drawn parallel to the axle. Points *a* and *d* are the projections on this line of the center points of the journals, so that *a d* is equal to *A D*, and *a* and *d* are connected with *e*, forming the triangle *a d e*. *Q'* and *Q''* are extended to *C* and *c*, which points are connected by the line *C c*. If vertical lines are now drawn from the wheel fit *B' B''* to points *C'* on *a e* and *C''* on the extension of *C c*, then the polygon *a C' C'' c d* is formed. This polygon determines the correct axle for the weight *Q* and the force *H*, as will be shown. But as *H* is liable to act in either direction, and both halves of the axle must be made alike, the polygon takes in reality the shape shown on diagram No. 2.

"In order to ascertain the shape of the axle, the distance between the wheel fits is divided in a number of equal parts (see diagram No. 2). From each of these division points a vertical line is drawn through the polygon. According to F. Reuleaux, the diameters of the axle at the different points *K*, *L*, *M*, *N* and *O*, stand exactly in the same proportion to each other as the cubic root of the distances *k*, *l*, *m*. *n* and *o*, or expressed mathematically:

$$\frac{\text{Diameter at } K}{\text{Diameter at } L} = \frac{\sqrt[3]{k}}{\sqrt[3]{l}}$$

"In the case of the master car builders' axle the diameter at *K* is 4⅞", *k* scales on the diagram 110, and *l* scales 101 hundredths of one inch. Thus:

$$\frac{4\frac{7}{8}}{\text{Diameter at } L} = \frac{\sqrt[3]{110}}{\sqrt[3]{101}}$$

And diameter at $L = 4.73''$

"In a similar manner the diameters at *M*, *N* and *O* are found to be 4.59', 4.44" and 4.29" respectively. If an axle is laid out according to these dimensions, you will find that it will conform very closely with the straight taper of the master car builders' standard axle."

After some little discussion the axle recommended was adopted as a standard of the association.

Next subject called up was the report of the committee on the question of

CAR COUPLERS.

Mr. Hickey made a verbal report to the effect that the committee had been unable to obtain data sufficient about the status of the automatic car coupler on which to base a conclusive report. He urged the members to interest themselves in the subject in all its bearings and prepare themselves to act on it, also to answer fully the questions that will be presented by the committee.

Mr. Mackenzie urged the convention to endorse the action of the Master Car Builders' Association in adopting the vertical plane type of coupler. Many of those present are in charge of the car department, and are required by their managers to put on the M. C. B. standard coupler, and he could see no harm in endorsing the coupler.

Mr. Setchel said there are many individual members of the association who have to do things which the association would never endorse. Favored investigating and giving good reasons for everything that was endorsed.

Mr. R. W. Bushnell wanted to know if it was within the province of this Association to decide on car couplers, or whether it was a criticism of the Master Car Builders' Convention they were acting on.

Mr. Hickey read an extract from the constitution, showing that the investigation of anything rela'ing to railroad rolling stock was within the province of the Association.

Discussion closed.

Mr. John A. Hill presented a report on resolutions returning thanks to various persons and interests for courtesies extended to the Association.

ELECTION OF OFFICERS.

The president announced that the next business was the election of officers, and he appointed James Meehan, J. H. Setchel and John Hickey as tellers.

The officers elected for the ensuing year were: President, John Mackenzie, New York, Chicago & St. Louis, Cleveland; First Vice-President, John Hickey, Milwaukee, Lake Shore & Western, Kaukauna, Wis.; Second Vice-President, Wm. Garstang, Chesapeake & Ohio, Richmond, Va.; Treasurer, O. Stewart, Fitchburg Railroad, Charlestown, Mass.; Secretary, Angus Sinclair, NATIONAL CAR AND LOCOMOTIVE BUILDER, New York.

According to a vote previously taken it was decided to hold next convention at Cape May, Montreal or Buffalo, the final decision resting with the Executive Committee. Secretary Sinclair was instructed to go personally to the place under consideration and select rooms to be retained for the members.

Meeting adjourned *sine die*.

Electric Motors Compared to Locomotives.

At the last Convention of the American Society of Civil Engineers Mr. Lincoln Moss read a paper giving comparative tests of an electric motor and of a steam locomotive on the Manhattan Elevated Railway, New York. A great deal of speculation has been indulged in about the possibility of operating the elevated railroads with electric motors rather than with steam locomotives, and the author of the paper, who is in the engineering department of the company, was detailed by Col. Hain, general manager, to ascertain by careful tests the relative economical value of electricity and steam locomotives.

The trials were made on the Ninth avenue line with the newest style of passenger cars which weigh 29,500 pounds each. Two cars were used first, then three and finally four. Electricity was generated by a first-class plant, located conveniently to the section where the tests were made, and the power developed by the engine while at work varied from 43 to 400 H. P. The expenditure of 43 H. P. was required when the train was standing at stations, that amount of energy having been consumed in friction, local currents, current waste, resistance and leakage.

Four generating dynamos, nominally 50 horse power each, were used. They could be worked in parallel or in series by means of a switch. The current was conveyed from the dynamos to the railway structure conductors by two insulated copper cables strung on poles. At the structure the cables were divided to connect with the three positive conductors on the east, center and west tracks.

The electric motor weighed about ten tons, and was carried on two pairs of driving wheels 48 inches diameter that were coupled together, and had a wheel base of six feet. The driving dynamo was carried on a supplementary shaft set above the back driving axle, to which it transmitted the power by means of gearing. The average power generated by the stationary engine was 176.8 horse power, while the amount converted into useful work at the track was only 26.7. The highest horse power developed by the motor was 52 horse power, and the lowest 9 horse power. The average efficiency of this means of transmitting power was found to be .151, and the average loss 48.9 per cent.

The greatest power of the engine was exerted when the train was starting and the motor showed the least efficiency at that time, proving that there is nothing in the oft repeated theory that an electric motor would start a train with less loss than a steam locomotive, which has to use the steam throughout the full stroke in starting. In working to start the train on a hard pull the steam engine exerted 395 horse power and only 7.6 of this was utilized by the motor, so that 387.4 horse power of energy was lost in transmission.

The action of an electric motor, says the author of the paper, bears some resemblance to that of a steam locomotive. In the latter, in starting, the distribution of the steam is the most wasteful, and the average pressure on the pistons is the greatest when "notched up" so as to expand the steam more economically, the economy is very much improved, and the average pressure falls comparatively low, but although low, it is applied so much more rapidly that a greater horse power is developed. So in an electric locomotive the electrical pressure is greatest when starting because of the "resistance" introduced, and the current used is greatest, owing to the absence of counter-electro-motive force; but as the speed increases and the resistance is cut out and the counter current increases, the electrical pressure becomes less, and also the current used, for it is evident that if the speed of the motor was increased enough the new or counter current generated by the driven motor acting as a generator would equal the current derived from the generating dynamo and no work will be done by the motor; so that when the motor is working rapidly and the impulses are of low pressure and quantity, the efficiency is the greatest, although it seems like a strange kind of efficiency which depends upon the development of an opposing force.

A great many trials were made under varying conditions, and one interesting fact among others developed is, that the economy with light trains at higher speeds becomes poorer, apparently contrary to the general principle that the economy of stationary electric motors increases with the speed and the reduction of the load, and many believed that a better showing would be made with such tests. It is true that tests made with light trains of two or three empty cars run at a high speed, but making no stops, showed much better results; but such conditions are not at all practical in operating elevated or other railways. It is true that a lightly loaded stationary motor, running at a nearly constant high rate of speed, will show maximum economy, but in the case before us, where the motor was changing its speed continually and stopping and starting, the rule will not apply.

It was found that the electric motor had not power sufficient to handle a train under ordinary working conditions, and it was determined, as a basis of comparison, to use a small locomotive to pull the same train over the same track at the same speed attained by the motor. The engine selected had cylinders 11 × 14 inches and two pairs of drivers coupled 36¾ inches diameter. Very careful tests were made with this engine by the same men who had tested the electric motor. The efficiency of the locomotive was calculated to be .85, as compared with .151 for electricity. By comparing the coal used by the stationary engine and the other expenses of running the plant with the coal used and other expenses incurred in operating the locomotive, it was calculated that the power from electricity cost 2.38 times that supplied by the locomotive to run the train at an average speed of 9.4 miles per hour. To supply the increased power for running the trains at 15 miles an hour it was estimated that electricity would cost 4.7 times that incurred by the locomotive.

In accordance with the findings of the Board of Mechanical Experts, appointed to consider the bids for the eight large lathes for the Washington gun foundry, the contract has been awarded to Wm. Sellers & Co., of Philadelphia, on their own plans, at $416,460.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE.
MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

AUGUST, 1890.

Subscription.—$1.00 *a year for the United States and Canada; $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

How the Compound Locomotive is Economical.

On another page under the caption, "How Can a Compound Locomotive be Economical?" we publish a letter from a well-known railroad man which contains a series of questions that embrace most of the current criticisms of compound locomotives. As we find many other railroad men asking similar questions, we shall endeavor to answer them as briefly as possible. We think, however, that railroad officers seeking for information on this subject, would learn much more by studying the articles on compound locomotives by Professor Woods that have been running through our columns for the last year, and the report on the same subject presented to the Railway Master Mechanics' Association at last convention.

The first question raised is, what is the advantage over any other class of engine carrying the same steam pressure? To this we would reply that the compound principle admits of more work being obtained from a given volume of steam owing to the greater measure of expansion, and it reduces the losses from cylinder condensation, beside giving a steam distribution that exerts an improved rotative effect on the engine's mechanism. With simple cylinders and ordinary valve motion, it is seldom practicable to obtain more than three volumes of steam expansion, so that little advantage is derived from increase of boiler pressure since it almost invariably results in a corresponding increase in terminal cylinder pressure. The simple cylinder does not provide scope for practice of the sound engineering dictum repeated by our correspondent—admit the steam at high, and exhaust it at low pressure. Even in exceptional cases where this has been accomplished, the results have not been entirely satisfactory; but they are better than the practice of exhausting the steam at one-third the boiler pressure, a pressure that with modern practice is as high as the initial pressure was a few years ago. Suppose the steam is admitted at 160 pounds absolute pressure, or a little over 145 pounds gauge pressure, and expanded to six times the original volume. The exhaust pressure will be about 26 pounds. The temperature of the steam on admission would be 363 degrees Fah., and at release it would be 242 degrees, making a variation in the temperature of over 120 degrees. The metal of the cylinder tends to adjust itself to the temperature of the steam, giving or taking heat during the recurring events of the strokes. The cool exhaust steam has imparted its temperature to the cylinder, and when the hot steam from the boiler passes through the ports at the beginning of next stroke it goes into a comparatively cool cylinder, the metal of which absorbs heat till it is raised to the temperature of the steam. Saturated steam is constantly on the dew point, and on the least portion of the heat of vaporization being abstracted, a corresponding quantity of the steam falls into water just as it does inside of a condenser. When the steam becomes water in the cylinder it loses its power to do mechanical work, therefore the percentage of steam that condenses through the interaction of the cylinder metal represents so much loss of power. A portion of the steam condensed becomes spray, and helps to dampen the steam filling the cylinder. When the steam is cut off and expansion proceeds, part of the heat is converted into mechanical work, and a proportional amount of condensation takes place. By the time the release point is reached the pressure of steam has become low and the relief of tension inclines the water to flash back into steam and it draws on the metal of the cylinder for heat which acts as fuel to turn the condensed water into steam. This happens during the period of release and return, when that end of the cylinder is open to the atmosphere, so the revaporization of the water represents unmitigated loss of heat.

In the compound engine the losses due to excessive cylinder condensation are prevented by avoiding extremes of temperature, and by utilizing part of the revaporized steam. The steam of 160 pounds absolute pressure and 363 degrees temperature would be cut off in the high pressure cylinder at about ¼ stroke to obtain six volumes of expansion and passed into a receiver at a pressure of 53 pounds and temperature of 285 degrees. The difference in temperature between the initial and the terminal pressures in the low pressure cylinder would be even less pronounced. Any revaporization of water that follows condensation in the high pressure cylinder does not cause much loss in a compound engine, for the regenerated steam passes into the receiver and is utilized to perform work in the low pressure cylinder instead of escaping uselessly into the atmosphere as it does from the cylinder of a simple engine. These are the causes that make expansion of steam in the successive cylinders of a compound engine more economical than the same ratio of expansion carried out in a single cylinder.

The rotational advantage of compounding is, that the pressure on the crank pin is more evenly distributed throughout the stroke than with a simple engine. Our correspondent and others familiar with marine engine history will remember how many attempts were made to obtain high economy of steam in simple engines by providing improved valve gear that enabled the steam to be admitted quickly and cut off expe litiously. The result always was an engine that proved extremely expensive for repairs, and did not develop the propulsive power that the indicated horse power called for. Admitting high pressure steam suddenly imparts to the connections a series of blows that are destructive to mechanism, and the maximum rotational effort is exerted while the crank is near the center when the leverage on the crank pin is short.

Our correspondent objects to the high percentage of back pressure in the high-pressure cylinder. That of course tends to detract from the power of the engine, but the designers of compound locomotives arrange their proportions to overcome this source of weakness. We commend his objection to the low initial pressure of the low-pressure cylinder back to the author for reconsideration, assisted by a calculation of the power developed in the low-pressure cylinder of the Michigan Central compound, as illustrated by diagrams in the NATIONAL CAR AND LOCOMOTIVE BUILDER of March last.

As to the assertion that the saving due to compounding arises from the higher boiler pressure employed, we believe our correspondent to be mistaken and misinformed. This is an argument that was pertinaciously repeated for years by the opponents of the marine compound, and there is good reason for believing that it has no more genuine force against the compound locomotive than it had with the other, although it is doing the best of service for those who are striving to discredit the evidence in favor of the latter form of engine. For convincing proof that there is nothing in the high-pressure steam argument, we refer doubters to the admirable report on compound locomotives to be found in the proceedings of the Master Mechanics' Convention published in another part of this paper.

Limits of Railway Speed.

There are several questions relating to railroad train-operating about which accurate information is urgently needed. Among engineers and other scientists there is decided conflict of opinion as to the character and force of the elements that cause train resistance. There is every reason to believe that the rules given in the text-books concerning train resistance are nearly worthless for speed above 20 miles an hour.

Among practical railroad men there is highly diverse views respecting the speed capabilities of a locomotive. There has never been an accurate test of how fast a high-speed locomotive could run under favorable circumstances. There are a great many loose traditions and speculations among railroad men as to the speed that has been attained by certain American locomotives, the belief in velocities achieved varying from 70 to 90 miles an hour. There is an authentic record of 83 miles an hour having been made by a four-wheel connected engine with drivers 68 inches diameter, and there is no reason for doubting that a greater velocity was possible with the same engine.

English engineers appear to think that the limit of locomotive speed is about 80 miles one hour. An article on the subject that recently appeared in a British engineering journal says: An interesting discussion has gone on in our pages for some weeks concerning the highest speed that it is possible for a locomotive to attain. The greater number of those taking part in the discussion seem to hold that a velocity of more than 70 miles an hour with a train or 80 miles an hour without one cannot be exceeded. The discussion is like many others in that our correspondents prefer to state opinions rather than give reasons; and it is noteworthy that even those best informed and most familiar with the working of a railway refrain from advancing any explanation of the alleged fact that 80 miles an hour is the maximum limit of speed. They take their stand on the basis that there is no trustworthy evidence that a higher speed has been reached. This is a very good argument, no doubt, so far as it goes, but it leaves the world in the dark as to the controlling conditions which restrain a locomotive in spite of all the efforts of its driver to run faster and faster. Some benefit may, we think, be derived from putting the whole question on another footing, and directing discussion into a channel which may lead to a practical result. It seems to be quite clear that if steam enough could be supplied to a locomotive engine any speed could be attained, unless the resistance to its progress augmented in such a proportion that the boiler pressure was not great enough to overcome it. The engine would then be, to use a marine phrase, "locked up." We know that at a velocity of as much as seventy-two miles an hour on a level, a well-designed single-driver light engine will run with the throttle but little open, and apparently exerting very little power indeed. It is not easy to see why an addition of eight miles an hour should pile up the resistance as it is said to do. The question seems, however, to bristle with anomalies and contradictions of the most vexatious and puzzling character; we are at times tempted to believe that these difficulties have no existence in fact, and are for the most part the creations of fancy.

Slipped Eccentrics.

A press notice recently intimated, that owing to the slipping of an eccentric on a locomotive belonging to the Housatonic Railroad Company, a passenger train was delayed for several hours. An incident of this kind deserves all the publicity that editorial comment can give it. A railroad company that undertakes to transport passengers is in duty bound to use every possible means to secure punctuality, and as a first means toward that end the locomotive and other members of the passenger rolling stock ought to be maintained in proper order. With modern high boiler pressures and large slide valves a very arduous duty is put upon the eccentrics of a locomotive, and the railroad company which fails to have these eccentrics, secured in the most substantial manner, is failing in its duty toward its patrons. Through mistaken ideas of economy or because those in charge of the mechanical department like to move eccentrics occasionally, some railroad companies continue to fasten the eccentrics of their locomotives with set screws alone. Set screws in any shape or form are unreliable as fastenings for the eccentrics of modern locomotives, and those who depend upon such unmechanical and unreliable means of keeping an important part of the locomotive in its place are trifling with the interests and convenience of the people who travel on railroads, expecting to reach their destinations punctually.

The setting of a slipped eccentric is generally a simple operation that can be performed in a few minutes when the man in charge understands his business. But if a set screw happens to be broken in the hole and keeps pinching the driving axle, turning the eccentric becomes a most difficult operation with the limited facilities generally available on the road, and it is an operation which an engineer should not have to perform. A well-fitted key admits of no movement of the eccentric, and there is no excuse for failing to have every eccentric fastened by that means. If a master mechanic or foreman wants to indulge periodically in the luxury of moving eccentrics, in connection with experimenting on the valve motion, an off-set key can be made that will admit of any desired change of position. It would, however, be to the interests of many railroad companies if those concerned would leave eccentrics severely alone. They are generally about right when they leave the builders or the back shop.

Abridging the Interval Between the Conventions.

We publish on another page a letter from a valued correspondent on the question that a joint committee of the Master Car Builders' and the Master Mechanics' Associations have under consideration, viz., the shortening of the time between the conventions. Our correspondent has figured out the number of members who belong to both associations, and makes the point that a necessity for bringing the time of the meetings closer together is not so urgent as it is reputed to be. The fact that two sets of men attend the two conventions, and that they cannot all be away from their headquarters at the same time, has not received the attention its importance demands. From conversing since the conventions with many members of both associations we are convinced that a radical abridgement of the time between the conventions would result in decided inconvenience to those concerned. It is the common practice for the Master Car Builders to return home to be on duty about the time the Master Mechanics leave for their convention, and any change that would make this arrangement impracticable would result in keeping one set of the officers at home. There were only eight or nine members of both associations who attended last Master Car Builder's Convention, and were absent from that of the Master Mechanics; and we had the personal knowledge that some of these re-

turned home to relieve master mechanics who wanted to attend their own meeting. A shortening of the time between the meetings might result in holding about half of those who did not remain over last year, and it would probably prevent five times the number of other members from getting to the second meeting. It seems very doubtful to us that the interests of both associations would be advanced by making much change in the time of meeting.

Convention Amenities.

A considerable number of railroad men who are members of both associations attended the Master Car Builders' meeting, but would not remain for the Master Mechanics.' Some have the good reason that they cannot give up the time for both, and they believe that, because of the rules of interchange and of the general interchange of car equipment, the Car Builders' Association needs first attention. Still other members do not like the methods of conducting business now followed by the Master Mechanics, and, instead of remaining to help, they go away and thus weaken the number of those who are trying to bring about reforms.

The above is an extract from an editorial article published in the *Railroad Gazette* on the convention of the Master Mechanics' Association. The article called forth a vigorous and dignified protest from Mr. J. Hickey, vice-president of the Association, in which he says:

In the interest of fairness and in justice to the large number of active members of the Association, may I ask you to state what the usages of the Association are in need of reform? What efforts have been made toward improving its working methods that have miscarried? What custom of the Association is so obnoxious as to justify prominent members from remaining away from the annual meetings? In short, wherein has the Association in any manner departed from its path of usefulness and honor?

The *Gazette* in replying to this says: We stated a "condition, not a theory," when we mentioned the fact that "a considerable number of prominent members who attended the first meeting did not stay for the second." We did not say that they were justified in going away, but on the contrary implied that they ought to have stayed if they could. Why they went away we cannot explain in any detail. Undoubtedly the Master Mechanics' Association was at some disadvantage in having its convention follow, rather than precede, that of the Master Car Builders. The joint committee appointed to consider the best arrangement of the conventions, will attend to this difficulty. Certainly there is considerable grumbling among the members concerning the conduct of its business; but we do not care to undertake to express for them complaints which are sometimes personal, sometimes matters of feeling difficult to express accurately, and generally inappropriate for public discussion.

Exactly, the "condition" was entirely a matter of personal feeling. The writer for the *Gazette* did not succeed in steering the business of the Association to his own liking, and he used the editorial pages of the paper to publish a malicious attack on the Association. A sorehead can generally find some one to sympathize with his "grumbling," but we make free to assert that very few members found any reason to complain of the manner in which the business of the convention was conducted.

Our contemporary writes as if the attendance at the Master Mechanics' Convention was small compared to the attendance at the Car Builders'. This is not supported by the facts. About 80 members, including associates, were present at the Master Car Builders' Convention, and 122, including 7 associate members, were present at the Master Mechanics'. That does not look as if the latter Association were languishing. Then about the assertion that a "considerable number of railroad men who are members of both associations attended the Master Car Builders' meeting, but would not remain for the Master Mechanics'." There were nine members of both associations who attended the Master Car Builders' and were absent from the Master Mechanics' Convention. Several of these returned home to permit their associates to leave for the Master Mechanic's meeting. The absentees who might have attended had the two conventions been closer together may be reckoned about five. The Master Mechanics would no doubt have welcomed the presence of these members, but their absence did not by any means impair the usefulness of the work done at the meeting. Our contemporary is really too reckless about the absence of facts. Editorial articles based on "matters of feeling" alone give the readers "that tired feeling" we have heard about.

Prospects of Operating Railroads by Electricity.

Electricity has made such rapid progress into favor as a means of transmitting power through small motors for a variety of industrial purposes, that progressive men naturally speculate on the practicability of transmitting by this means the power required in operating railroad trains. The application of electricity to the operating of street railways has been surprisingly rapid and successful. To-day 25 per cent. of the street railway companies are reported as having become electrical or have contracted for electric motor equipments, while among the newer roads more than one-half propose to operate by electrical methods, using either overhead, conduit or storage battery system. With this tangible progress into the operating of street railways accomplished, it is natural to think that a short step forward will provide the means whereby ordinary railroads can be operated economically by electrical transmission. Those who entertain such sentiments will be interested in two papers recently read before engineering societies. At the Cincinnati convention of the American Society of Mechanical Engineers, Mr. Willis E. Hall, of Altoona, read a paper on "Working of Railroads by Electricity" in which he took a decidedly favorable stand as to the practicability of operating surface railroads by electric motors. His plan is to divide the road into sections of 30 to 40 miles, with electrical circuits that length. He calculated that by the concentration of power with the most economical types of engines and boilers in use, a decided saving of cost in operating would be effected, even allowing for a loss of 50 per cent. of electricity in transmission. The advantages that he anticipated, beside reduced cost of operating, were the doing away with water tanks and stand pipes, with all the resulting delay to trains in using them, and the reduction of parts of machinery that are liable to get out of order and cause delay. He expected there would be an advantage to the electrical method by the reduction of the internal friction of the driving mechanism.

The paper was rather crude, but it elicited some masterly criticism. Mr. F. A. Scheffler, superintendent of the Westinghouse Electric Company's Works, estimated that it would cost $219,356 to provide a stationary plant and conductors for a section of 30 miles. Supposing a locomotive uses eight pounds of coal per horse power per hour, he calculated that the operating of an electric motor would cost $12,475 a year more than a locomotive capable of working at 300 horse power. The electrical conductors for the circuit would have to be copper rods one inch thick.

The other paper referred to, a synopsis of which will be found on another page, was read by Mr. Lincoln Moss at the meeting of the Society of Civil Engineers, and described comparative tests made in operating a train on the elevated railroads of New York with an electric motor and a steam locomotive. This test was carried out by the engineering department of the road and its object evidently was to find out the relative economy of the two systems of transmitting power. The engineer who made the tests evidently worked in the interest of no theory or preconceived conclusion. It is very apparent that all he wanted was facts to make reports from. The data collected from the very ably conducted tests led to the conclusion that it would cost about four times as much to operate the elevated railroads by electricity as it does with locomotives.

Although the operating of street railways is decidedly cheaper than operating by horses, it does not follow that electricity would be cheaper than locomotives for any kind of road. The use of electric motors for operating railroads would no doubt put an end to many nuisances and disagreeable features connected with the use of steam locomotives, but the change would be likely to involve inconveniences not now experienced. It would not do for surface roads to be operated by a system of electrical transmission where short circuiting or an accident to the conductors would paralyze the whole section. The traveling public using surface roads would not tolerate for a week the inconveniences that passengers on street and suburban cars are frequently called on to endure through defects of electrical appliances. Operating of surface railroads by electrical transmission of power may come to pass some day, but very material advances in the system must take place before that time.

Air Resistance to Trains.

Some months ago, Mr. C. I. Crosby, a military engineer, read a paper describing experiments he had made to ascertain the air resistance offered to bodies moving at speeds ranging from 20 to 130 miles an hour, and the results obtained are exciting considerable discussion among engineers and other scientific investigators. There has been considerable conflict of authorities and great diversity of opinion as to the laws of atmospheric resistance to bodies moving within the range of train speeds, but the text books teach that the resistance increases as the square of the velocity. This is said to increase in the case of projectiles to the cube of the velocity. Mr. Crosby made a series of what appear to have been very carefully conducted experiments with small cars run on the Weems electric railway, and he found that the air resistance does not increase as the square, but directly with the velocity. If this be true, the atmospheric resistance to a train running 40 miles an hour would only be twice that encountered when the train was running 20 miles an hour instead of four times, as we are informed by the recognized authorities to be the case. In certain cases it seems the air resistance increases as the square of the velocity, but there is every reason to believe that this law does not apply at the speeds at which trians are run. It seems very desirable that more experiments should be carried out to settle the matter beyond dispute. Professor Hazen, of Washington, writes to the *Engineering News* vigorously disputing the correctness of Mr. Crosby's conclusions, and offering to conduct experiments on railroad trains to ascertain exactly what the atmospheric resistance amounts to at various speeds. He has been unable to find a railroad company enterprising enough to supply him with a locomotive and cars with which to make the necessary tests, which is very much to be regretted. Railroad companies are more interested than any others in the establishing of the correct laws of air resistance to trains, and it is to be hoped that some of them will provide Professor Hazen with the required facilities for making the tests.

Personal.

Mr. Frederick Knowland, of Plainfield, has been appointed general manager of the new Croton Valley road.

Mr. E. H. Dewson, for some time master mechanic of the St. Joseph & Grand Island, has entered the employ of of the Union Pacific.

Mr. Matthew Ellis, general master mechanic of the Chicago, St. Paul, Minneapolis & Omaha, has been suffering from sickness that confined him to bed for several days.

Mr. John Hillhouse, assistant master mechanic of the Wheeling & Lake Erie, died last week at Atlantic City, N. J., where he had gone for his health. He was formerly with the Michigan Central.

Mr. D. F. Jack, general manager of the Jacksonville, Tampa & Key West, has resigned. He has held the position about a year, and was formerly manager in Florida of the Southern Express Company.

Mr. F. H. Phillips, assistant superintendent of the Mohawk division of the New York Central & Hudson River road, died at Little Falls, N. Y., this week. He entered the service of the company as a messenger boy, and was appointed assistant superintendent about ten years ago.

While on his way to attend at Cleveland a meeting of the Executive Committee of the Railway Master Mechanics' Association Mr. John Hickey was seized with a severe illness in Chicago. We are pleased to learn that the sickness was of brief duration and that Mr. Hickey is about again.

Mr. S. H. Harrington, who left the Erie a few months ago to become mechanical engineer of the Gould Coupler Company, did not make a long sojourn outside of railroad work. He has resigned the latter position and gone to be mechanical engineer of the Big Fours, with headquarters at Indianapolis.

Mr. John Wilson, assistant superintendent of motive power of the Union Pacific, has been for years collecting facts for a book of rules, tables and data for mechanical engineers. Only the lack of time, due to leading a busy, active life, has prevented him from arranging the work for publication before this time.

Our correspondent, Mr. William Voss, has been elected assistant secretary of the Fox Solid Pressed Steel Co., Chicago, of which he has for some time been assistant engineer. He was called to Europe by cablegram on urgent business connected with the company early last month. Owing to his absence there will be a break in his articles on "Railway Car Construction."

Mr. J. A. Sague, who has been for a few months master mechanic of the New York, Lake Erie & Western at Rochester, has resigned to become superintendent of motive power of the railways on the Island of Jamaica. Mr. Sague was for some time mechanical engineer of the Erie at Susquehanna, having gone there from the West Shore. He is one of the bright young technical school men drawn into railroad service by Mr. R. H. Soule while that gentleman was superintendent of motive power of the West Shore.

M. de Routkowsky, technical agent attached to the Russian Legation at Washington, is a graduate of a railway engineering academy in St. Petersburg that appears to impart a thorough training to the young gentlemen who pass through its curriculum. We recently met M. Routkowsky at the Westinghouse Air Brake Works at Pittsburgh, and found that he not only had an intimate acquaintance with all railroad matters in Europe, but that he was particularly well versed in all details relating to American railroad machinery and methods of operating the roads.

Joe Hadden, who came to America in 1833, and ran the first locomotive on the South Carolina Railroad, is still living in South Carolina. The old man is now well up in age, having reached his 85th year. He is in a comparatively destitute condition, having accumulated little if any of this world's goods, and is entirely dependent upon the charity of the good people of that section, and what little he can make in repairing machinery. It has been a matter of surprise to his friends that the Brotherhood of Locomotive Engineers has not sought out this old veteran and given him a helping hand. That organization, however, feels under no obligations to help this veteran of the craft, for he never connected himself with the order when he was a working engineer.

During part of the session (Master Mechanics' Convention) two men sat side by side whose railroad history would read like a novel; one was John Y. Smith, inventor of the vacuum brake, who served as superintendent of machinery of the military railroads of the United States during the civil war; the other was John O'Brien, who served as a master mechanic under the stars and bars, and who took charge of the mechanical end of the enterprise when Stonewall Jackson made his famous raid into Maryland

and captured 38 locomotives on the Baltimore & Ohio, and took them south across the country. Mr. Smith was a man of nearly 50 years of age when the war broke out, and had had experience from the very birth of railroads, having at the age of seven been a boy in the shops of the great George Stephenson. Mr. O'Brien was but a boy of 20 or 21 when Fort Sumter pulled down her flag. Mr. O'Brien is still in active service as master mechanic of the Petersburg road at Richmond, while Mr. Smith has long taken matters easy on the fame and fortune he made with his brake, yet he has always been a busy man, and has today a new invention in the shape of an exhaust pipe, on plan of his vacuum-producing apparatus in the brake, that bids fair to be a very useful device. There is no jet black hair on either of these heads now, but all of the white ones are honored ones, and no one thinks of giving one more credit than the other for his services—because each did the work allotted to him in the best manner that he was capable of.—*Locomotive Engineer.*

Inviting Railroad Men to Become Shareholders.

President Fish, of the Illinois Central Railroad, has issued a circular inviting employés to become owners of stock in the company by purchase. President Fish says in a statement to the *Railway Age:*

"The company has no stock for sale, but it proposes to assist any of its officers or employés to buy one share at a time at a fair market price to be fixed when the purchase is made, the purchaser to pay for his share in sums of $5 or multiples thereof. On the sums so paid interest is to be credited at the rate of 4 per cent., and when the sum at the credit of any purchaser amounts to the prices at which the stock was bought he shall receive a certificate for his share of stock, and can then, if he wishes, begin the purchase of another share. The purchaser may, however, at any time have his contract cancelled and his money returned to him with interest, and shall so receive it whenever he leaves the service. Thus the company assumes the entire risk of a fall in the price of the shares and the expense of doing the work.

"It is hoped to enlist every frugal person in any way connected with the corporation as a partner on a basis of the utmost liberality to the small proprietors. It is not proposed to form a savings bank, a mutual benevolent or a life assurance association, the experience of the company being that the men prefer to handle these matters for themselves.

"My belief is that the plan when properly presented will induce greater thrift among the men and, through their example, spread among the people the habit of saving and of investing in the securities of the railroad which runs past their doors and in which the State of Illinois already has so large a proprietary interest, the ultimate object being to produce in the west that community of interest between the citizens and the railways which has given to Great Britain and to the eastern states the perfection of railway service and the most profitable of investments for small proprietors—sound dividend-paying railway shares."

Tests of Two Schenectady Locomotives.

A recent issue of the Schenectady *Union* says: Two large locomotives just turned out by the Schenectady Locomotive works are at work on "The Hill" pushing trains on the New York Central. The engines are built for the East Tennessee, Virginia & Georgia Railroad for freight, one being a plain consolidation with cylinders 20 inches in diameter by 24 inch stroke and 126,000 pounds. The other a "compound" consolidation in every respect a duplicate of the plain engine, excepting in the fact of its being compound instead of simple. The cylinders of this engine are 20 and 29 inches diameter by 24 inches stroke. It is expected the compound will show a saving in fuel of 20 per cent. over the simple engine. The engines are being indicated with a view of getting their relative power, and are both doing excellent work.

Mr. W. H. Thomas, superintendent of motive power of the road for which the engines are built, is here inspecting their working, and expresses himself highly pleased with the results thus far obtained.

Novel Method of Preventing Collisions.

A Washington paper describes the test of an invention which is considered by the newspaper men who witnessed it as being of the greatest importance in the safe operating of railroads. The paper says:

"A test was made of the electric railway signal of the Universal Electric Railway Signal Company, of Richmond, Va. About three miles of the track on the Baltimore & Ohio has been provided with this signal system by way of experiment. The apparatus consists of an electric circuit formed by a single iron rod, which is laid between the tracks, and a wire brush attached to each engine in connection with an electric gong and telephone. Two engines approaching each other on the same track come into circuit at the distance of one mile and a half or more, according to strength of the battery, and at once the telephon bells ring. This is a signal for the trains to stop, and the engineers may talk with each other on the telephone to discover the trouble, whatever it may be. Two trains were sent out on the Baltimore & Ohio with a party, including several gentlemen from Washington and Virginia and correspondents of newspapers in different parts of the country. The tests were made and proved extremely satisfactory."

We have no doubt that a test of the kind can be worked out very satisfactorily as a curious experiment; but as a practical means of promoting the safe operating of railroad trains, it ranks with the telescope pilot, the extra wheels to prevent derailment, and the thousand other inventions brought out by men who do not have any conception of the functions of railroad mechanism. Practical men who appreciate properly the improvements necessary to promote the safety of train operating, have decided that an efficient signal service is the best means for keeping trains apart. Engineers telephoning to each other to keep away is a striking idea, but it won't work.

Making Aluminum.

Alloys of aluminum are taking such an important part in the arts that any particulars that can be gleaned about the production of the parent metal are of general interest. During a recent visit to the offices of Hunt & Clapp, Pittsburgh, we were shown a most attractive collection of articles made from pure aluminum manufactured by the Pittsburgh Reducing Company. The pure metal is used mostly for the manufacture of fancy articles for which its beauty and freedom from tarnish eminently fit it, and for articles wherein a combination of strength and lightness is desirable.

The metal used as an alloy with copper makes a particularly strong mixture, a tensile strength as high as 60,000 pounds per square inch of section having resulted from this combination. Aluminum bronze is on this account used to a great extent in machine work where a non-corrosive metal of great strength is required. It is also used considerably for bearings of electric light plant and is slowly but surely making its way as a material for car journal bearings.

At the Pittsburgh Reducing Company's works, we found the process of separating aluminum from the ore going on. The method of refining is partly a patent, partly a secret operation. Electricity is used to generate the heat required to fuse the ores, and the melting is done in crucibles through which the current is passed. This company does not produce the metal directly from the crude ores, but use a partly refined product imported from Germany. The factory is turning out about 300 pounds of pure aluminum per day. A considerable portion of the product is sent to Chicago to be used in making car journal bearings.

Making Westinghouse Engines.

In the course of a recent visit to the Westinghouse Machine Company's Works at Pittsburgh, we found the officers in charge busy making changes that will facilitate production and keep the output of the establishment equal to the demands upon it. They are building a new erecting shop that will be equipped with the very best means to be had for the handling of the work, and the foundry will be extended and a cupola erected that will melt ten tons of iron a day. The various types of compound engines built have become highly popular and the demand for them has gone beyond the capacity of the present shops, although they are very large and are carried on in a systematic manufacturing basis, which greatly facilitates production. As the engines permit of constant reproduction of the same sizes and finished shapes, this company has been able to make unusually good use of special tools for securing accuracy and rapid finish of the engine parts. Mr. Bagley, general manager of the works, holds very sound views about the advantages of systematic manufacture, and under his control the works are run on a highly enlightened basis.

A striking feature about the work done in these shops is the severely rigid methods of inspection and testing. When an engine is finished, and is in the condition that would be called ready for shipment in other establishments, she is here taken to the testing department and set to work performing the most trying kinds of service. While the engine is under this ordeal, indicator diagrams are taken under all conditions of work and the exhaust steam is condensed to ascertain the actual water required to produce each horse power developed. The results obtained are made a permanent record. If the engine passes this ordeal satisfactorily she is not declared ready for shipment. By no means. She is taken all apart and every detail of the castings, joints and mechanism carefully examined to see that no flaws or defects have been revealed by the hard work.

They use natural gas to very good advantage in these works, everything requiring heat being supplied from that source. They have a peculiarly good arrangement of core ovens, the cores resting on movable shelves that open outwards on the doors. They use a reverberatory furnace of peculiar construction for the melting of brass, and the metal is run off and poured like cast iron. There is a great saving of work by the plan, but it may waste some metal, although that may not follow, as the metal is worked gradually forward in the furnace toward the hottest point and is not fused till nearly time to be drawn out.

Electric Headlights.

At a recent meeting of the Association of Railroad Superintendents, Mr. M. B. Leonard read a paper on "Electric Lighting in Railroad Service," in which he said:

"For several years experiments have been carried on with the view to adapting the arc light for use in the headlights of locomotives. It was quickly ascertained, however, that the constant vibration of the locomotive seriously affected the feeding mechanism of the lamp, and consequently the brilliancy of the arc; but recently the improved feed apparatus and the adoption of a copper negative pencil, instead of the carbon hitherto used, have been found to eliminate the difficulties, and the National Electric Locomotive Headlight Company, of Indianapolis, is now ready to furnish headlights of this description, the current being generaeed by a small combined dynamo and engine, carried on the locomotive. The engine is about 3 horse power, and has four cylinders. It weighs about 700 pounds, with the dynamo, which is about 2,000 watts capacity, and is placed over the smoke arch of the locomotive between the headlight and the smoke-stack.

The trials of the apparatus made last November on the Vandalia Line showed that on very dark and rainy nights the fences to the cattle guards could be seen three-quarters of a mile away; a light-colored car would show as an obstruction on the track at about that distance. At 800 feet, a tie at the side of the track would be ptainly seen. Horses and cattle showed up clearly 1,000 feet ahead, and the colors on a switch target could be seen a quarter of a mile distant.

The Ensign Car and Manufacturing Company, at Huntington, W. Va., has broken ground for an addition 70 × 70 feet to its blacksmith and machine shops. The Ensign Company has not had an idle day for want of business in a long time, and this addition is made necessary by increasing business.

The Portland Locomotive Company has delivered to the Maine Central Railroad a heavy mogul locomotive, being one of four which the company is building. The engine is one of the heaviest ever built by the Portland Company, and heavier than any on the Maine Central. It is intended for passenger service on the mountain division. The cylinders are 19×26; driving wheels, 5 feet 5 inches in diameter.

A company has been organized to build car works at Montgomery, Ala. It is stated that it has secured 15 acres of land in that city and that some of the machinery has been ordered. Work on the foundations for the buildings will not be commenced until about Sept. 1. The company has a capital stock of $200,000. The officers are: President, Charles Webster, of Phillips, Wis.; general manager, Captain Burr, of Stephens' Point, Wis., and general superintendent, Edward Gilbert, of Oshkosh, Wis.

A Wall street authority says: "Electricians have been discussing a remark said to have been made by Henry Villard just before he sailed for Europe that it would be well to go cautiously in respect to certain expenditures for locomotives, because it was probable that within a few years the motive power of every railroad in the United States would be changed." It may look this way to the hopeful speculators of Wall street, but to men who are watching the details of the phenomenally rapid progress of electricity as a means of transmitting power there is nothing to indicate that railroads will ever be operated more economically by electricity than by steam locomotives.

Our New South Wales exchanges have lately been commenting at great length on a train accident that happened on one of the railways there, by which four persons were killed and many others injured. A mixed train broke in two while ascending a steep grade and for want of proper braking power behind the rear portion of the train ran away and came in collision with another train causing a most diastrous wreck. A thorough investigation of the cause of the accident was made by the coroner's jury and a great many railroad men were examined. One of the government experts testified before this jury that nowhere in the world were automatic brakes used on freight cars!

The Southern Pacific Company having experienced difficulty in keeping the oil lamps lighted in the Oakland yards, tried the experiment of lighting twelve of these lamps from the electric light circuit. So satisfactory were the results, that the number of signals so lighted has been increased gradually until 134 lamps in the interlocking and automatic signals, switch stands, switch lights and signal towers there are now lighted by electricity. Thirty-one of these lamps are in switches and signals that have underground wire connections, 16 of them light up four signal towers, while the balance are in signals located on posts and connected by overhead wires, all being supplied by an arc light dynamo owned and operated by the company The expense of keeping these lights running is reckoned at $90 a month. A plant of 45 lamps performing similar service on an Eastern road costs $100.50 a month.

How Steel Tires are Made.

LOCATION OF THE LATROBE STEEL TIRE WORKS.

Latrobe is a familiar name to most railroad men because once upon a time there were car shops at the place. Latrobe is a small town about forty miles west of Pittsburgh and situated in a beautiful valley that seems almost entirely surrounded by wooded mountains. The region is outwardly sylvan but beneath the district is rich in mineral treasures, coking coal and natural gas being abundant. Here beside an ever-flowing stream, in the midst of inexhaustible potentialities of cheap mechanical energy, the Latrobe Steel Works Company have established their plant for the manufacture of railroad tires. Nature has been particularly bountiful in the supply of the necessities for a metallurgical establishment, and the gentlemen controlling this company have done all that art, skill and experience could accomplish to make their works perfect for the production of first-class steel tires.

The spot selected for the works is a fine level plain, 70 acres of which belong to the company. The foundation of the shops is about 30 feet above high water of the stream, which gives an abundant supply of water entirely free from mineral impurities. The shops consist of two main buildings, with a number of smaller structures for offices, etc., at a convenient distance away. Both the large buildings are 86 feet wide, with a 45-foot lean-to, and are 34 feet in height. The melting shop is 175 feet long, and the forge is 300 feet long. These buildings are so placed that the material all goes in at one side, and gradually works forward through various fiery ordeals till it emerges from the inspection house in the form of a tire, ready to encircle a car or locomotive wheel. Yet the two main shops are so arranged that one or both can be extended without interfering with the plan of continuous operations.

Thinking that our readers would be interested in learning something about the operations carried on in what has been stated on good authority to be the most perfectly equipped tire making establishment in the world, I spent a day last month in examining the machinery and watching the work done. Tire making is a highly interesting operation, and one that nearly all railroad men would profit by examining.

SELECTION OF METAL.

Accompanied by several of the officers connected with the company, who displayed a commendable willingness to give all the information desired, I started on my tour of inspection at the point where the crude metal from which the steel is made is received. The company keep on hand a highly varied assortment of metal, from which selections are made for the mixtures best adapted for tire steel. There are puddled iron blooms, select pig, rail end scrap Swedish pig, dephosphorized pig and foreign structural scrap, beside a supply of ferro-manganese and spiegeleisen. The latter two metals, as most of our readers will be aware, are carbides of iron that are of great value in steel making, being principally used to regulate the percentage of carbon in the heats.

CHEMISTRY IN STEEL MAKING.

While looking at the metal selected for the furnace and having the chemical composition of the various heaps explained, I was very much struck with the important place that chemisty holds in modern metallurgical operations. Only a few years ago all selections for steel making were done by experts, who judged the composition of iron by its fracture. Some men became highly successful in making these selections, but the best of them failed frequently and none of them obtained scientific accuracy. The judge now of the metal is the chemical analyst. So many pounds of puddled iron, so many pounds of certain pig and so many pounds of steel scrap are not selected according to their appearance, but according to the quantity of pure iron in them as certified to by chemical analysis. The change from the old to the new method was substituting accurate measurement for skillful guessing. Under the new method steel tires ought to wear more uniformly and be more exempt from fracture, and all other kinds of machinery and structural steel ought to be more satisfactory than that made under the old practice.

A certain class of metal workers vigorously opposed the introduction of the chemist into steel making, but, as usual, ignorance was worsted in the battle of progress. The superintendent of these works is a chemist, who graduated at a technical college and worked his way upward through the testing departments of various iron works. There is now no steel making works of any standing in the country that does not have its operations regulated by chemistry.

THE OPEN HEARTH FURNACE.

The melting of the metal that makes mild or open-hearth steel is done in a Siemens regenerative furnace. The furnace is built of fire-brick, and has a rounded hearth which is covered with a refractory sand that saves the brick from rapid destruction by the heat. On this hearth a charge of pig iron is laid, which forms the bath into which the other mixtures are thrown. When the calculated quantity of pig iron is put in, the gas is turned on and supplied with the air necessary for effecting perfect combustion. The resulting flame "reverberates" over the metal and soon melts it. A curious sight it is to watch the iron succumbing to the penetrating power of the hot gases. The edges of the lumps soften first, and they begin to run like the sharp points of lumps of grease exposed to a hot sun, and the physical travail of metal is reflected by a glaring light that rivals in penetrating power an accumulation of arc lights. Gradually the whole mass dissolves amid much turmoil, and then the whole bath boils like a huge caldron of water. Great bubbles work up through the mass like steam rising to the surface of a boiler.

By this boiling process the excess of carbon present in cast iron is burned out, and the men controlling the operations can tell pretty closely by the reduced violence of the ebullition how much carbon remains in the mixture. Puddled iron, scrap steel and other material thrown into the cast iron bath quickly melt and become a part of the charge. After the flame passes over the molten metal on its way to the chimney, it passes into a mass of honeycomb-like brick work, which absorbs the greater portion of the heat remaining in the gases. The inlet and outlet to the furnaces are so arranged that the direction of the incoming gas and air can be changed. As soon as the brick work gets highly heated, the gases going toward the furnace are passed through it, and the heat that would be wasted but for this arrangement is used to raise the temperature of the incoming gases. This is the "regenerative" principle.

POURING THE STEEL.

When the mixture in the furnace has boiled to the point where the expert in charge considers the metal in proper condition for pouring, three or more small test ingots are poured. These ingots are sent to the tests department and subjected to very careful chemical and physical examination, which is kept on record, and the fate of each charge depends upon the report of its quality. Sometimes a charge may be too high or too low in hardening elements, and for that cause has to be rejected; but mistakes of this kind are very rare, for the men employed to supervise the operations are all experienced and skillful steel makers. The charge is then run into ingot molds, the size of the mold being regulated by the size of tire the ingots are required for. A steel ingot looks in shape like a monster cake of charlotte russe.

They have a peculiar method of pouring the ingots in these works which is different from anything which I have seen elsewhere. The common plan is to set the ingot molds open end up like so many cheese boxes and pour in the metal. Here the molds are set on a plate with the open end down. On one part of the plate stands an open pipe like the stand pipe in a locomotive dome but lined with fire clay. Smaller clay pipes lead from the base of this stand pipe to the mouths of the molds. The molten metal is poured into the stand pipe and passing through the various smaller pipes fills the molds by an upward flow. This practice is said to produce an ingot that is much more exempt from blow holes than those poured downward.

UNDER THE HAMMERS.

When the laboratory reports announce that the charge is satisfactory, the ingots are weighed and marked. They are then matched for weight to suit the future tires, and taken to the rolling mill. Here they are first placed in a heating furnace. This furnace is of peculiar construction. It has a sloping floor thirty feet long. The furnace at the upper part where the ingots are put in is comparatively cool. The ingots are gradually worked forward to the point where the heat is most intense. By this means the ingot is heated gradually and cracking is prevented. The heating furnaces are very conveniently arranged flanking two steam hammers that perform the next operations on the blooms. The heated blooms are handled by a most ingenious machine called for want of a better name a "gripping crane." This machine, which consists of an arrangement of horizontal levers and embracing jaws performs in a Herculean manner the functions of a human arm and hand. The mechanism is operated by hydraulic cylinders, and the apparatus is capable of movement in every direction. It swings round a large circle and the hand part grasps an ingot and carries it round to the anvil of the great hammer, where it is deposited with careful nicety. This 20-ton hammer then imparts a few blows to the hot ingot, turning it into the shape of a flattened cheese. Tho hand of the gripping crane then takes a punch out of a rack and places it in the middle of the ingot when the hammer descends and drives out a hole that in future operations is enlarged to become the inside of the tire. After the punch is returned to it place and several other operations performed, the gripping crane takes the ingot, which is now a "blank," and hangs it on a monster horn attached to the anvil of a smaller steam hammer. The blank is revolved on the horn, and all the while the hammer keeps striking blows obliquely upon the outside edge of the blank. This bevels the periphery of the blank and begins the formation of the flange. The hammering which the blank receives here and under the heavier hammer is for the two-fold purpose of bringing the metal toward the form of a tire, and for making the steel more compact. There is so much mechanical work converted into heat and transferred to the metal by the blows of the hammers that the blank is said to be hotter when the hammering is finished than it was when the ingot was taken out of the furnace.

IN THE ROLLING MILL.

When the blank leaves the small seven-ton hammer, it has assumed the form of a big ring. This is next taken to another heating furnace and heated for the rolling mill. This rolling mill is different from any other machine used for tire making and is a surprisingly ingenious apparatus for effecting the purpose of its design. It is the invention of Mr. Julian Kennedy, consulting engineer for the company, who has displayed great constructive ability in the production of a machine that performs with wonderful accuracy a succession of complex operations that can be reproduced indefinitely in endless succession. The mill is formed of a combination of rolls that grasp the blank and compress it in every direction while rolling it into the required shape. The principal rolls stand in a vertical position, and hold the former which gives the tire the required shape. This, of course, acts on the outside of the tire. Another vertical roll set inside the tire pushes it toward the former. Horizontal rolls grasp the sides of the tire and keep them at the proper size. Hydraulic cylinders provide the power that acts on the rolls to make them squeeze the tire. When the tire is placed in position and the machine started, an enormous pressure is put upon the metal as it is worked into shape and the production of a particularly solid tire is the result. There are many refinements of design in the rolling mill which want of space prevents me from mentioning. They will be readily appreciated by any mechanics who may visit the establishment. The blank is put into the mill at a yellow heat, and it is worked under a pressure of about 2,000 pounds to the square inch until it falls to a dull red heat, at which low temperature it is finished. The visitor is struck with the painstaking care devoted to the minutest detail of tire rolling.

From the mill the tire goes to the inspection department where a very thorough search is made for defects that might shorten its period of service. None of these being found, it is sent to the machine shop to be bored out and thence to the storage department to be ready for shipment. The greater part of the railroad companies require the tires to be bored out before delivery.

They have a machine shop finely equipped with all the tools necessary for the business and the whole plant bears the imprint of having been designed by a master head. The fine natural gas supply is very intelligently utilized not only in the furnaces but in every place where heat is required. The officers of the company are all men with long experience in steel tire making and they all appear to be actuated with the desire to secure for the Latrobe Works the reputation of making tires that are second to none.

A. S.

Locomotives for Jerusalem.

There were shipped last week by the Red Star Line of steamers three engines built at the Baldwin Locomotive Works for the new railroad from Jaffa to Jerusalem. This road is said to be the first one ever constructed in Palestine, and is being built by a French company for the Ottoman government. It is the first of a series to be built through Palestine and Asia Minor. The engines built at the Baldwin Locomotive Works are moguls, with three pairs driving wheels and two-wheel driving trucks in front, and eight-wheel tenders. They are one meter narrow gauge. The cylinders are 15 × 18 inches, and the driving wheels are 41 inches in diameter. Each engine without the tender weighs 29 tons, and the tender 24 tons. The grades of the new railroad are 2 per cent., or 105.6 feet per mile. The engines are guaranteed to haul 165 gross tons of cars and loads up that grade. The engines are named Jaffa, Jerusalem, and Ramleh. An engineer has been sent to put them in working order. It was necessary to send the engines during the summer season, as there are no facilities for unloading, and storms prevail in the Mediterranean during September. The cars are being built in Belgium. At the Baldwin Locomotive Works ten very heavy engines are being built for the Mexican Central Railway, twelve for the Interoceanic of Mexico, twelve for the Mexico & Pacific, and eight for Japan. Three rack-rail locomotives were shipped recently for the Manitou & Pike's Peak road. Dr. Edward H. Williams, a member of the firm, has just returned from a tour in Egypt, India, China, and Japan.—*Phila Public Ledger.*

The order for 50 flat cars and 10 box cars for the Duluth & Winnipeg which was placed with the Minnesota Iron Car Company has been transferred to the United States Rolling Stock Company, who expect to be able to deliver the cars this month. The change was made because the Minnesota Company found that it would be unable to turn out the cars on time. The cars are being built with Winslow patent roof, Janney coupler, Butler drawbar attachment, National hollow brake beams and the Fox solid pressed steel center plates.

The Philadelphia & Reading has received 10 new fast passenger locomotives, to run between Philadelphia and Jersey City. The tenders have scoops to take up water from the track tanks. These are the last engines of the 50 ordered of the Baldwin Works last fall. The 40 freight engines have been in service some time.

The Lafayette Car Works, of Lafayette, Ind., are building 325 tank cars of a capacity of 72,000 gallons each, for the American Cotton Oil Company, and 225 tank cars of the same capacity, for the Manhattan Oil Company; the company is also building for the Kansas City Packing Company 250 Chase refrigerator cars.

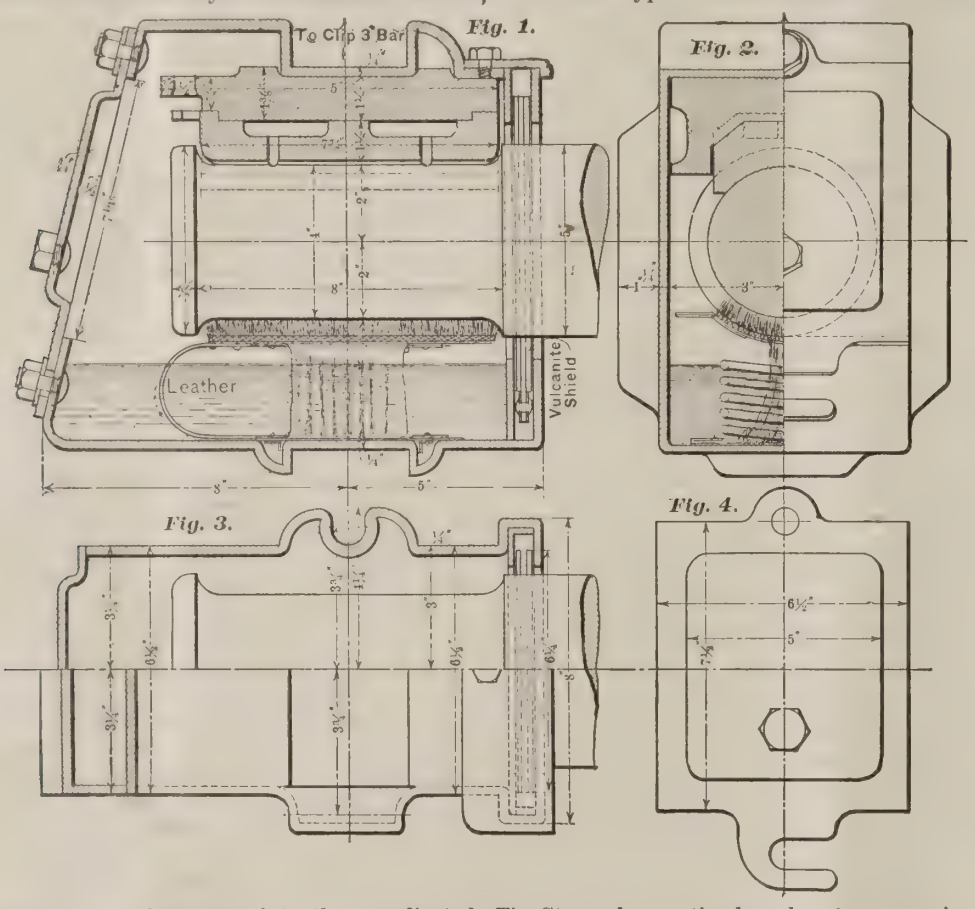
Stamped Steel Axle Box.

The practice of introducing pressed steel parts in car construction that have hitherto been made of cast iron is making rapid progress and promises to result in a very important reduction of dead weight. Our readers are familiar with what the Fox Solid Pressed Steel Co., of Chicago, and the Schoen Co., of Philadelphia, are doing in this line of improvement. These firms are making stamped steel to replace the simpler forms of castings, and their labors are meeting with the cordial support of car builders. We are now informed that an English firm has successfully introduced pressed steel axle boxes for cars, and we have no doubt American steel makers will be prompt to follow in the same direction.

We reproduce from *Engineering* the annexed illustrations and description of a stamped steel axle box. Regarding the invention our contemporary states:

Of course many attempts have been made to supersede the ordinary cast-iron axle-box, as the immediate economy is evidently great. The most natural method was to use cast steel, and this has been tried very perseveringly. But the form of an axle-box is not one which is suitable for production in cast steel, since it does not lend itself to even cooling. The result is that honeycombs, and bad and unreliable castings, are frequent, and cast steel has been found in many cases less reliable than iron. Another method is to form the boxes of mild steel plate, pressed to the requisite form. After long experiment this method has been worked out to a very successful conclusion.

It does not need a second thought to show that no better material than mild steel could be found for an article that has to stand the fearfully rough usuage to which an axle-box is subjected. The difficulty is to determine how it



can be worked at a moderate cost into the complicated shape required to fit existing guides and hornplates, and to be perfectly interchangeable with the present boxes. How this has been done will be seen by reference to the engravings on the present page, in which Fig. 1 to 4 represent a stamped steel axle-box of the pattern chiefly in use on all bogie wagon stock.

Referring to Figs. 1 to 4, it will be seen that this is an oil box, fitted with a greasing pad and spring (Fig. 2) in the usual way. The box is made of plate one-fourth inch thick; its upper part is filled with a cast-iron slipper in which the brass fits, and since every box is made with the same dies there is the certainty that the slipper will fit exactly if it be also to pattern. It is such a simple casting that it can scarcely fail to be. The opening in the box is covered with a stamped door (Figs. 1 and 4) which turns on a stud.

As a test a wagon was fitted with boxes of this description, and for several hours was violently shunted by an engine. No harm happened to the boxes, although other parts of the vehicle suffered. Indeed, it is difficult to see what could befall a box of this description, beyond, perhaps, a bruise which could be easily taken out by a smith. It is very light and exceedingly elastic, while the thinness of the plate enables the heat to dissipate readily, and thus not to waste the grease by undue melting.

The extreme lightness of the stamped boxes to which we have just briefly referred is a very important feature. It is computed that there are over 1,000,000 wagons belonging to railway companies and traders in use on the lines of the United Kingdom, which means a total of 4,000,000 axle-boxes, some of which weigh 120 pounds and others from 95 pounds upward, the average being about 100 pounds. The steel box weighs two-thirds less on an average than the cast iron. The saving, therefore, of dead weight on 4,000,000 boxes would amount to over 100,000 tons.

Railroad Mechanical Progress.

A the last meeting of the American Society of Civil Engineers, President Shinn in his inaugural address said The mileage of railroads in the United States at the end of 1889 was 161,382 miles. At the end of 1888 the rolling stock consisted of 29,398 locomotives, 27,712 cars in passenger service, and 1,005,116 freight cars. It is probable that not less than 1,100,000 freight cars are in use. Unfortunately, no national statistics of car mileage are collected, but there is reason to believe that, while commendable progress has been made in freight car capacity and in the hauling power of locomotives, the average movement of freight cars still remains in the vicinity of 25 miles per day, so that on the average the freight cars of the United States stand still during nine days for every day they are in motion. The efforts of the writer while in charge of the New York & New England Railroad showed conclusively that with a proper system of demurrage charges for delays in loading and unloading cars their average movement could be increased more than 50 per cent., and that, too, without any serious inconvenience to the patrons of the road.

About 63 per cent. more freight was moved in 1888 than in 1882, and during the same time the number of freight cars increased about 48 per cent.

In other departments of railroad economy improvement is manifest. In compound locomotives I apprehend that the Baldwin four-cylinder compound will be found superior to the Webb compound, tested recently on the Pennsylvania. The Michigan Central two-cylinder compound has drawn a train weighing 359 tons 228 miles with a consumption of a little over seven tons of coal. Other engines of the same type used seven tons in running 152 miles

The Strong locomotive has also given promise of economical results.

In power brakes for freight cars a great advance has been made. The Westinghouse Air Brake Company reports 101,576 freight cars equipped with its brake at the beginning of 1890, or about one-tenth the freight car equipment of the country.

The record of Janney couplers as given in *Engineering News* of Feb. 15, 1890, appears to show that they stand the shocks of service quite as well as couplers of any other type. It appears safe to say that within the present decade all freight cars will be equipped with automatic couplers.

In this connection it is well to refer to the Westinghouse friction buffer as an additional safeguard. This device has shown excellent results under severe tests. It seems clear that with automatic brakes, automatic couplers and such buffers it will be possible and safe to very materially increase (perhaps double) the average speed of freight trains.

Best Forms of Exhaust Pipes.

In the course of a private letter to the editor of this journal about the methods of investigating "Exhaust pipes, nozzles and steam passages—the best form and size in proportion to cylinders," Mr. A. W. Gibbs, master mechanic of the Richmond & Danville, and a member of the committee of the Railway Master Mechanics' Association, having the above in charge, says:

It seems to me that the great difference in the design of single nozzles is due to the fact that one designer aims to produce a continuous discharge without regard to the back pressure, while others try to discharge the steam as quickly as possible without causing back pressure, but ignoring the fact that in so doing they may produce a severe tearing effect upon the fire.

The first can be done by greatly enlarging the pipe at the top of bridge, which makes a receiver of both exhaust passages, and to some extent of the cylinders, but from the cards that I have seen, this is accompanied by an injurious wave of back pressure near mid-stroke. The other plan aims to do all of the accelerationof the exhaust steam before the passages merge, and treating the upper part of the pipe as a device for straightening the discharge, so that it shall produce the mxaimum effect.

Which of these plans is the best should in my opinion hinge on the quality of the fuel. I have seen coal which burned so freely that it was very difficult to check it with the dampers, and economy dictated that it should be fired very thinly. I should judge that this would produce the best effect with continuous blast, and the first pipe would probably be the best.

Some other coals lie almost dead when blast is off, and seem to do best when a heavy fire is carried. With these I should prefer the second style of pipe.

Am in hopes that we can so plan that the discharge from one cylinder will produce a partial vacuum in the other, and though we have not yet succeeded have avoided all blowing over.

Prizes for Railway Improvements.

Once every four years the Society of German Railway Directions offers prizes of the total value of £1,500 for important inventions and improvements effected in matters relating to railways. This sum is to be distributed as follows: (A) A first prize of £375, a second of £150, and a third of £75 are offered for improvements in the structural and mechanical department. (B) A second set of prizes of the same values as those above mentioned are offered for improvements in locomotives and rolling stock and their maintenance. (C) One first prize of £150 and two second prizes of £75 each are offered for improvements relating to railway management and working and to railway statistics; also for essays and other literary work of exceptional merit in reference to railway matters. Without in any way curtailing the scope of the inventor or laying down any lines for the jurors, the following subjects are suggested as suitable for the competition: *a.* Design and construction of a locomotive boiler which, without material increase in weight, is safe against explosions, and the maintenance of which costs less than that of the present type. *b.* Improvements in the design of locomotives, especially with regard to the valve gear, so as to effect a more economical use of steam. *c.* Proposal for a simpler method of calculating rent for railway wagons. *d.* Production of a durable and useful coupling hose for steam heating or continuous brakes on rolling stock, without the use of india-rubber. *e.* Construction of a suitable and inexpensive shunting brake for goods wagons. Should no inventions be received under groups A, B, C worthy of the first prize, the jurors may so divide the prize money as to award several prizes of second and third degree. The conditions of the competition are as follows: 1. Only the inventions, improvements and literary productions, the production or publication of which fall within the time specified for the competition can be entered. 2. Every invention or improvement, before it can be admitted to the competition; must have been practically executed on one of the railways belonging to the Society of German Railway Directions, previous to its being entered, and the railway in question must support the claim for the prize. 3. The application must be accompanied by descriptive drawings, models, etc., to enable the jurors to fully judge the merits of the invention or improvement. 4. The award of a prize does not prevent the competitor from patenting his invention. 5. The society has the right to publish particulars of the inventions which have received prizes. 6. Of literary works sent for competition three printed copies must be supplied. A jury composed of twelve members of the society shall judge the competitions and award prizes or not. Prizes in accordance with the above particulars are now offered for the period of eight years from July 16, 1883, to July 16, 1891, and applications are to be forwarded between the dates of Jan. 1 and July 15, 1891, to the directors of the society, 3 Bahnhofstrasse, Berlin, S. W.—*Engineering.*

The history of the hammer forms a curious page in the developments of science. Of all the tools used in the industrial arts it is clearly the one which could be the least dispensed with, and for this reason it is probably one of the oldest mechanical devices of man. And yet it is only within our own days that any real advance has been made on the primitive hand machines of our ancestors. Even now there are some industries which habitually use hammers of the clumsiest shape and design. The gold-beater will, by preference, use a kind of mallet, with which, however, he is able to beat out gold into layers of such exceeding thinness that 250,000 only amount to a single inch. In the same way, the filecutter's hammer is an extraordinary looking weapon, which, despite its rude and misshapen appearance, can in practiced hands, turn out results with which no machinery can compete. Where, however, weight is required, as in the forging of iron, or the driving of piles for bridges and docks, it is obvious that no human muscles can deliver blows of sufficient impact with any weapon wielded by the arm,---[*Ex.*

Communications.

Reducing the Time Between the Meetings of the Mechanical Associations.

Editor National Car and Locomotive Builder:

If the programme arranged for the joint committees of the Master Car Builders' and Master Mechanics' Associations to work on about bringing the meetings closer together is strictly adhered to there will be no harm done and good will result. But there are some badly balanced persons who are striving to arrange for one meeting beginning immediately after the other is finished, an arrangement that I, with many other car builders, feel would not work satisfactorily.

I might call your attention to a very important element in this matter that should be considered. Previous to the last meeting, the Master Car Builders' Association had 240, the Master Mechanics' 307 members. Of these only 86 were members of both associations, leaving 154 car builders that have no interest in the Master Mechanics' meeting and 221 master mechanics that have no interest in the Master Car Builders' Association. In a majority of these cases it is not convenient or permissible for both the Master Car Builders and Master Mechanics to be away at the same time, therefore the necessity of sufficient time to intervene for the Master Car Builders to return home and the Master Mechanics to go to the place of meeting. It would be quite reasonable to have the Master Car Builders' convention to commence Wednesday, giving three days the regular time, and Saturday for any possible overflow business, and let the M. M. open their convention the fol lowing Tuesday. What a mess there would be if the plan of some one to close the M. C. B. convention on Wednesday and open the M. M. on Thusday, if the M. C. B.'s could not get through in three days.

I feel quite certain that the plan to meet at the same place and in the following week, with an interval of from Friday to Tuesday, will suit a majority of the members of both associations. The opposition would be among the superintendents of both departments, the gallant 86 and the "lobby." The 154 and 221 want you on our side and we are sure to win.

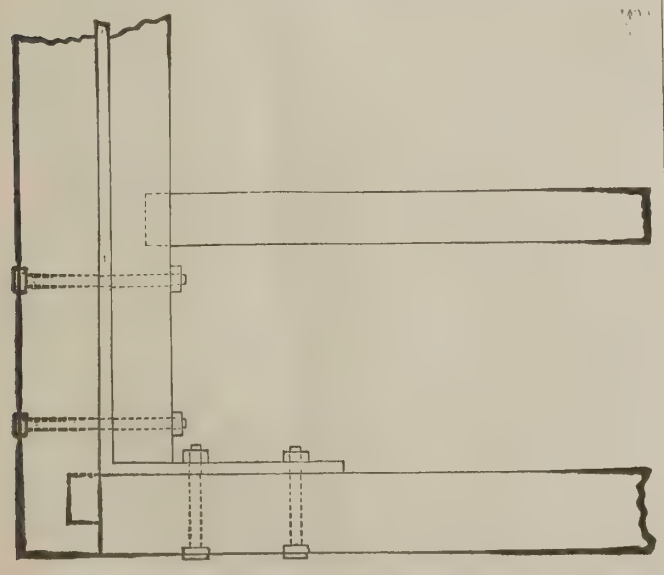
MEMBER M. C. B. A.

Strengthening the Ends of Cars.

Editor National Car and Locomotive Builder:

In reference to some comments made by "Car Builder" in July number of NATIONAL CAR AND LOCOMOTIVE BUILDER on my article in the June issue of same, kindly permit me to make a few statements regarding the question at issue, not for the purpose of getting in the last word, but merely to make my meaning plainer if it is possible. Not being an eyewitness of the casualty referred to (in fact, never saw the construction of the official car commented on), my information is simply from an eyewitness.

The construction of the end sill with ¾-inch × 8-inch iron plate was undoubtedly what saved the car, for the reason that the locomotive struck the car a lifting blow, the pilot beam of the locomotive striking the end sill of the car, which was strong enough from the nature of its construction to resist the blow. Of course, the locomotive did not telescope into the car as "Car Builder" would lead us to believe, for if it had, it is very doubtful if the car



would have come out as well as it did. The credit is all due to the design of the end-sill and the favorable conditions of the blow. Does "Car Builder" or any practical man believe for a moment that if the locomotive (or a car of smaller outside dimensions) had struck this official car and had gone over the end sill, that it would have come out so well as it did?

It is an undisputable fact that a large majority of telescoping casualties are the result of uneven platforms, permitting one car to rise above the floor of the other, breaking down platform and crashing through end framing, very often leaving the end sill of the raised car intact; this was the case with the two cars ahead.

"Car Builder's" plan for framing end sill is certainly a very good one and worthy of imitation. If used with the truss attachment, as shown in Fig. 5 of my article in June issue, would be almost impreguable.

As to my plans being incomplete, they fully illustrate all they were intended to do. As to "Car Builder's" queries and remarks in latter part of his article, there is no reply to make, as there is nothing in my article calling for same.

I would suggest an improvement to "Car Builder's" plan of end sill, which will do more to hold it up and square with frame of car than the joint bolts he uses. (Joint bolts are quite ancient in car construction, don't you know.)

PROFESSIONIST,

Smith Exhaust Correction.

Editor National Car and Locomotive Builder:

I notice in your July number of the NATIONAL CAR AND LOCOMOTIVE BUILDER you say I claim the Smith Exhaust saves 70 per cent. of coal. This is a mistake. I only claim from 28 to 30 per cent. Please correct.

GEO. E. VAN BRUNT, Master Mechanic.
PENNSYLVANIA & NORTHWESTERN RAILROAD CO.
BELLWOOD, Pa., July 18, 1890.

Slipping of Driving Wheels.

Editor National Car and Locomotive Builder:

As there has been considerable discussion of late concerning the slipping of driving wheels of locomotives when running with the throttle closed, I propose to give you my views in the matter.

When the throttle is shut the drivers drive all that is connected to them instead of being driven. Suppose we take a locomotive in running order and jack it up so that the drivers are clear from the track (or perhaps the experiment would be more satisfactory if the driving wheels are removed from the shaft and cranks put on the ends of it for the purpose of making connections), and then apply power sufficient to turn the driving shaft 280 turns in a minute, that would be the number a 54-inch wheel would have to make to run 45 miles an hour. It is plain to be seen that we not only have to put everything in motion connected with the drivers, including weight of the parts, compression in the cylinders and friction, and that all must be stopped and started or the motion reversed at every stroke of the pistons, and the pistons make four strokes at every revolution of the wheels, or 1,120 in a minute. I think, if the above experiment should be tried and, the power computed, the result would be surprising, and the question settled that speed is sometimes obtained on long steep grades sufficient to cause the drivers to slip, for it matters not, as far as that is concerned, whether the drivers drive the pistons or the reverse; the point of resistance in either case is the adhesion of the drivers and when that is overcome all know the result. An engineer asks, "Why is it that the drivers will slip so long after shutting off steam." My answer is, the longer the engine runs after the throttle is closed the dryer the cylinder gets, consequently, the greater the friction on the packing, making more resistance to be overcome.

E. W.

SPRINGFIELD, Mass., July 1, 1890.

Removal of Balanced Valves.

Editor National Car and Locomotive Builder:

In the July issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER I find an article headed "Removal of Balanced Valves," in which it is stated that on roads which had "long and heavy grades it had been found necessary to take out the balanced valves and replace them with those of the ordinary type," and blaming the balanced valve for causing the fire to burn as briskly while running down grades as when using steam. We have no engines with "balanced valves" running from here yet. The action of fanning the fire has been noted here and takes place with the ordinary slide valve, whenever the so-called "relief" valve is used. As I understand valve action I find no difference in the action of the piston of an engine, when running without steam, and it is only in using steam that the "balanced" valves are to show their value, but in running down grades with the lever in the "corner" the piston will draw in and expel just as much air with a common as with a balanced valve, and as the relief valve furnishes the steam chest with all the air it wants, which at the return stroke is sent up the stack, fanning will go on no matter what valve is used, so long as the relief valve remains attached and ready to furnish air at call. The old engines here that have no relief valves can be run with greater economy of fuel if they are anywhere near in fit condition for service than the new ones which have this device on and are in prime shape.

WM. WEILER.

Editor National Car and Locomotive Builder:

Under the heading Removal of Balanced Valves in the July number appeared one of the most comical fairy stories, so conflicting with the established laws of plain, every day, common sense mechanics, that it requires considerable nerve on the part of the writer to refrain from treating it as a huge, deep joke, brought on probably from the CAR BUILDERS' too frequent contact with the surf bathing at Old Point Comfort in June.

After stating that balanced valves had been removed from the engines on some roads having long continuous down grades and replaced with ordinary valves, the reasons for making the exchange is given as follows:

"The difficulty, etc." (see second paragraph).

Now let us analize the cylinder and steam chest under such conditions. The cylinder becomes a pump, the piston drawing air in through the ports and forcing it out through the exhaust nozzles.

We also know that a balanced valve is nothing more nor less than a plain ordinary valve so arranged on its upper side that the steam pressure is reduced to a minimum on its top area when at work so as to correspondingly reduce the great wear on the seat and valve gear. Nothing less nor nothing more. The sizes, shape and conditions of the under or port sides of the "balanced" and "ordinary" valves being identically the same. Consequently the relative conditions of opening and closure of the ports in both cases are the same. So that really nothing was gained by making such an exchange but a *loss* is sustained and a step backward into the rut of old fogyism is made.

But you say, "so much air is drawn in through the relief valves." Then the fault must lie in the relief valves and not in the slide valves, and as a remedy why not close up or remove the relief valves?

But to come to the point at once, don't you think an engine whose "fires burn as brightly running down hill as when working under steam," must have a wofully small throttle supply, or else an outrageously large relief valve opening, in order for the two conditions to be equal? Don't you sympathize with the poor fireman in his efforts "down grade"? And instead of "a choice of two evils," haven't you hunted up an old abandoned "evil" in the scrap pile of ancient time and put it in place of improvement and advancement in science and engineering.

W. S. ROGERS.

[The article on "Removal of Balanced Valves," which has roused the wrath of our correspondents, accidently slipped into our columns during a hurried make-up of the paper caused by the rush of work following the conventions.—ED.]

How Can a Compound Locomotive Be Economical?

A prominent officer of motive power of one of the largest railroad systems in the country writes us as follows:

I would be obliged to you for some information on a subject that I cannot clearly see through, viz., compound locomotive. What I am after is—what is its advantage over any other class of engine carrying the same steam pressure? I have never seen any compound locomotives, although I have conversed freely with gentlemen who have seen them working and helped to construct them, and who have claimed a saving of from 15 to 40 per cent. over the ordinary type of locomotive. I am conversant with the marine type of "compounds," and have had some practical experience with them and can see where the economy comes in on them, but the conditions are so widely apart in locomotives that I fail to see how the influences that make a marine engine economical apply to them. The object in compounding in a marine engine is economy in fuel, saving of space in the engine room, increasing the boiler pressure, adding as little extra weight to the engines as the excessive high pressure would call for, and to obtain the greatest efficiency in the expansion of steam. On the "Atlantic liners" they aim to carry about seven pounds back pressure for service on the low-pressure cylinder, and this cylinder is jacketed with a steam-tight jacket, steam being admitted all the time the engine is at work to prevent condensation of steam at such a low pressure while the process of expansion is carried on. In many instances the expansion falls below atmospheric pressure, the vacuum being an important factor of power in a marine engine, especially so in a compound engine on account of the excessive area of the low-pressure cylinder. In a compound locomotive, say carrying a pressure of 180 pounds boiler pressure, there would be a back pressure of about 90 pounds. This the initial pressure would have to contend with or work against, reducing the efficiency of the high initial pressure. Again, the low pressure cylinder has a low initial pressure without any assistance except the steam to complete the stroke. A locomotive running at a high rate of speed has very little time for expansion; in fact, unless you cut an engine up short she will not clear herself, and if she does not clear herself at the rate of speed she is going at, she will reduce her speed until she can clear herself. I shall not attempt to dispute the fact that a compound locomotive has shown a saving in fuel, but the saving has not been accomplished through the compounding principle—the saving comes from the use of high pressed steam; the ratio of increase of power from a few additional pounds of pressure far exceeds the expectations of any man that has not made a practical test of it and noted the results. An increase in power at a small expense of fuel is certainly economy,

My views of economy, or to compete with a compound locomotive on fuel, would be to carry the same pressure the compound locomotive carries, reduce the diameter of the cylinders a little, cut the engine up short on the links, using balanced valves, and throttle wide open. There is one small advantage that the valve on a compound locomotive might have, and that is when working, as I understand they work steam about 12 inches. This gives a better valve motion when a link is used, compared with a shorter travel. The true principle of an engine is to get as high an initial pressure as possible, cut off promptly and complete the stroke with expansion. These features are principally abolished in a measure in the compound locomotive.

[We have commented on this letter in our editorial pages.—ED.]

A French Speed Recorder.

It is known that a tuning fork sounding the normal "la" vibrates 535 times per second. If a piece of horse hair is attached to a branch of the fork and connected with proper mechanism, the vibrations of the fork can be registered graphically on a cylinder. M. Sabouret, a French engineer, has invented a speed recorder whereby the vibrations of a tuning fork are made to indicate the speed of a train. He places in a small box, a tuning fork and recording cylinder and puts the box under the railroad track. Four small pedals are then placed temporarily on the rail, and these are connected by india-rubber tubes to the register box. The wheel of the engine on reaching this point, presses on the pedals, which compress successively the air in the tubes. This compression is transmitted to the mechanism and sets it in motion, and the indication takes place as above. When the locomotive has covered six meters, one of the wheels presses on the last pedal, and the compression of the air in the last tube stops the indicator. It only remains then to count the number of vibrations.

The French scientific journals speak of this invention as being of the greatest practical value. One journal says:

"The speed of the train is thereby mathematically regulated; that is, it not only starts and arrives punctually, but the speed throughout the journey is regular and the engine driver does not by losing time during one part of the journey find himself obliged to unduly increase the speed during another part, to the detriment of his engine and of the railroad which are constructed for fixed maximum speeds."

From this and other notices we have read about the invention, we have concluded that a device which an American trainman would call an impractical crudity is found in France to be a wonder of scientific accuracy. The committee of the M. C. B. Association investigating the best material for brake shoes find their work greatly hampered for want of an absolutely accurate speed recorder. They had better look into the French tuning fork plan.

Effects of Brick Arch and Length of Flues on Boiler Efficiency.

The engineering department of the Paris, Lyons & Mediterranean Railway are engaged in making a most thorough investigation into the influence for economy of various proportions of locomotives. A report has been made on the variations in economy of locomotive boilers with different lengths of tubes, fire brick arches and water arches, that contains many edifying particulars. A special boiler was made for the tests of about the same dimensions as those used on the large passenger engines, and an ingenious provision was made for lengthening the boiler that experiments might be made with flue tubes of various lengths. There were 185 tubes about two inches diameter; the fire box had 24 square feet of grate and 109 square feet of heating surface. The fire-box was so constructed that it could be used plain, or with a short or long brick arch or with a movable water table similar to one patented in this country by Mr. W.H. Lewis, of the Chicago, Burlington & Northern, and illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER of January, 1886. Tubes varying in length from 9 feet 3 inches to 21 feet 7 inches were experimented with. Efficient means were taken to record the vacuum and temperature of the fire box. The air required per unit of coal consumed was measured, the combustibles were all carefully weighed, and the weight of cinders carried through the tubes under different conditions of working was recorded. Each of the series of trials was made with three different amounts of vacuum in the smoke box, viz.: 1 in., 1.77 in., and 2.95 in. Each trial lasted three hours.

It was found that the most satisfactory results were obtained from tubes from twelve to fifteen feet in length. The increase in length beyond that increased the evaporation efficiency very slightly. The decrease of efficiency is rapid as the tubes are shortened below 12 feet. Shortening the tubes reduces the proportion of heat imparted to the water, and increases the temperature of the smoke-box gases. The diminution of economy with short tubes is greatest when the plain fire box is used, and least with the long brick arch or water table. The length of tube does not perceptibly affect the throwing of sparks. Increasing the vacuum in the smoke box increases the loss due to short tubes. The maximum consumption of coal per hour on each foot of grate was about 150 pounds. In the case of American locomotives burning 200 pounds of coal per hour on the same unit of grate area, it is probable that a longer tube would show improved results, as the temperature must necessarily be higher than that used in the French tests

It was found that the long arch and the water arch produced about the same degree of economy, both of them being superior to the short arch, and the short arch in its turn increased the efficiency above the plain fire box. With an ordinary vacuum of 1.77 inch the short arch increased the economy 6 per cent., while the long arch and the water arch increased the economy to 8 per cent. When shorter tubes are employed the long arch increased the economy from 9 to 12 per cent. The economical effect of the arch was most decided with a combination of short tubes and high smoke box vacuum, conditions that prevail to a great extent in the operating of American locomotives.

The stronger the draft the less perfect the combustion in the fire box. This is most decided with the plain fire-box and is most feeble with the long brick arch. An ordinary fire-box requires the admission of more air for effecting the perfect combustion of a given weight of coal than one provided with a brick arch. The quantity of air required for each unit of combustible diminishes as the draft is increased. The economy of the boiler diminishes constantly as the draft is intensified. The influence of the vacuum on steam production is so decided, in spite of its action in economy, that the recommendation was made to provide the means of varying its intensity between the greatest possible limits. A variation of the vacuum was asserted to be the best means of giving a locomotive a wide range of power which could be regulated to suit the varying demands of service.

The conclusions reached by these experiments agree very closely with the deductions drawn by Mr. John Martin some 10 years ago in regard to experiments he made with locomotives in Peru and reported in the proceedings of the American Railway Master Mechanics' Association.

Case-Hardened Steel Crank Pins.

In the course of a discussion at the Master Mechanics Convention Mr. J. S. McCrum said: "I never considered steel satisfactory for crank pins; consequently, I commenced using iron crank pins case-hardened. But within the last six or seven years I took up the subject of mild steel case-hardened for crank pins, and I have met with better success with these than I ever did with iron. I was for a time in doubt whether it was a wise thing to undertake the case-hardening of any kind of steel, but I was assured by the best authorities that there was no danger in doing so, and I commenced the practice, and I never have had a properly designed and proportioned mild steel case-hardened pin break. The results obtained would, I believe, surprise a great many members of the Association. At the time when I was in doubt about the policy of using mild steel case-hardened for crank pins, I had some 19 x 24 engines built at Rogers' in which I specified Lowmoor iron pins. In a service of less than three years three of the Lowmoor pins broke.

I had a test made of this low grade of steel to see what the change in the character was after the case-hardening process. The section tested had, in its original condition, a tensile strength of 57,250 pounds, and an elongation of 27 per cent. After being case-hardened the tensile strength had increased to 80,240 pounds, with an elongation of nine per cent. Whether that was a safer material after case-hardening than before is a question I do not undertake to define. However, assuming that it is not the tensile strength that the pin has to render, so much as the bending strain, it would seem that the material, after having been case-hardened, was better adapted to that purpose than before.

How a Drummer Stopped an Express Train.

A group of railroad men were talking about a poor man who got on to a through train instead of a local, and on finding himself carried past his destination, jumped off and got killed.

"That man died because he was born deficient of cheek," remarked a member of the Ananias Club, who had listened to the conversation.

"Yes, Mac," replied Superintendent Smith, "you would have been equal to the occasion and saved your bacon."

"Boys," continued the speaker, "did you ever hear how Mac managed to stop the cannon ball train at Auburn, a way station, when she was forty minutes late?"

None of them had heard the particulars of Mac's latest feat of ingenuity in subjecting train movements to suit his personal convenience, and the superintendent continued. Mac was going West on our cannon ball train and he was intensely anxious to get off at Auburn. He tried the conductor, but Jim Hardy, who was on that day, would not stop for the President without a written order. Mac interviewed the engineer and asked if it was not possible to have a hot box about the time Auburn was reached and intimated that it would be worth money, but he soon found that there was no hope in that quarter.

He had almost given up the case as hopeless and was walking despondently through the train, when he was accosted by a particularly fresh-looking lumberman and called for his opinion as to the prospect of getting a smile in that yer train. A bright idea struck Mac. "Just wait a few minutes," whispered Mac, "and I'll tell you what to do."

Mac got his grip in a convenient place, and as they were nearing Auburn he said to the wood chopper, "You pull that rope and the conductor will come along and give you what you want." The son of the woods pulled the bell rope and the train began slowing up. The conductor came rushing along with fire in his eye, and the lumberman stopped him and said he would take a little whiskey straight. In the midst of the heated dialogue that ensued Mac slipped quietly off the train.

Licensing Locomotive Engineers.

It would seem to be about time for locomotive engineers to pass an examination in their calling and be licensed, the same as other engineers are. We read daily of delayed trains on account of broken side-rods and slipped eccentrics, which are the merest trifles as derangements, and should not delay a train ten minutes. Side-rods, indeed, have been taken down and the engine under way again inside of six minutes. We believe it to be a fact that very few locomotive engineers can reset a slipped eccentric, when not only they, but every fireman, should be able to do it by the mere sense of feeling, and in the dark. A blind man can set a slipped eccentric on a locomotive and have her cut square, too.

On locomotives the eccentrics always stand toward the crank pin. Look at the clock; when the crank pin is on 12 the eccentrics stand at figure 10 and figure 2, widest parts on the figures. This is where there is a rocker-arm, as in all standard engines.

Here is an item which speaks volumes:

"The 8.18 train, Friday evening, was delayed *several hours* by the slipping of an eccentric on the engine (No. 27). A special was made up at this station to convey the crowd to stations further north."

This was on the Housatonic Railroad. Railroad managers ought to get out diagrams and post them in every cab.—*Engineer.*

The business men of Denver are reported to have contributed liberally toward a fund for the entertainment of the railroad passenger agents who meet in convention there.

Mr. William Weiler, of Port Morris, N. J., is doing a very useful work among the enginemen who are ambitious to obtain information about the science of their business. He has got up a very useful but simple form of model that shows the working of the link motion. He mails this model and a copy of "Sinclair's Locomotive Engine Running" for $5. By means of the model and the book a man can learn a great deal about valve motion.

The American Steel Car Wheel Company, of Boston, Mass., have made at the request of several well-known Railway Master Mechanics a test of their wheels to see what effect the heating of the rim or tread and flange would have while keeping the plate in a cool state; the plate and hub was buried in sand and the rim heated in a charcoal fire; the first was heated hot enough to burn wood, without any effect on the plate; another was heated to a dull red, in the same manner, also without effect. This was considered as a severer test on the expansion and contraction than any wheel would ever be subjected to during the hardest kind of service.

The following is from a Wilkesbarre, Pa., paper: The Lehigh Valley locomotive, "Col. J. H. Horton," which was recently manufactured under direction of James N. Weaver, master mechanic at the Sayre shops, was the attraction about the railroad yard here yesterday. This locomotive is numbered 526, and is equipped equal to any locomotive that runs on any railroad. The cab is Queen Anne in style, having stained glass windows; the metal work is nickel plated. In the cab there is a large clock and a large steel engraving of Col. Horton. The exterior of the locomotive is striking in appearance. One side of the cab bears the inscription "Col. J. H. Horton" and a large picture in nickel plate circular frame 15 inches in diameter. The locomotive is called the "palace on wheels," and has a regular run on the Geneva and Sayre division, Mr. Vaughn being the engineer and James Vail the fireman.

Superintendent of Motive Power Heyward, of the Pennsylvania Railroad Company, has in his Jersey City office a relic of the primitive days of railroading. While a gang of men were excavating in the Jersey City yard for the new station they unearthed a medium-sized wooden wheel, with hub and spokes made of hardwood, while it was bound with iron and had the flange to show that it was made to run on a rail. It is concluded that the wheel once belonged to one of the first passenger cars built in this country. It greatly resembles the small wheel of a truck and is in a good state of preservation. How it found a resting-place beneath the surface of the ever-busy Pennsylvania yard cannot be conjectured, but it is thought that years ago when the old cove was being filled this relic, with other old rubbish, was dumped into the gap. It will now be kept to commemorate the early days of railroading in New Jersey.

Springs with "V"-Shaped Bands.

The A. French Spring Company, Pittsburgh direct our attention to the valuable improvement in elliptic springs introduced by them three years ago. A letter relating to the subject says:

It is now some three years since the first springs with this style of band were put in service, and we have refrained from any endeavor to induce its general use until we were fully assured of its adaptability and advantages. Up to this date, some 500 springs for use on locomotives and tenders have been fitted with these bands, and have been in service for various periods during the past three years. And we have reports up to date that there has not been a single failure, and not a leaf broken in a spring with the "V" band.

We take the liberty of inserting extracts from several reports which we have received.

"I find that the "V" shaped band driving springs have been in constant service since September, 1888, without any repairs, which certainly speaks well for them, as the weight of the engine on which they are applied is 62,000 pounds on the drivers.

I would further say, in regard to the "V" shaped band springs, that, in my opinion, it is the proper method, because there is a greater amount of elasticity received on the lower leaves, the engines are more easy riding and the liability of breakage is much less. We have a class of engine which weighs 80,000 pounds on the drivers on which we are using the "V" shaped bands on the springs, and since the introduction of this spring we have had remarkable success in regard to renewals; the easy riding of the engine is noticeable and, in my opinion, we are having much better results than was formerly the case."

"The springs with the 'V' bands referred to were placed under one of our heaviest engines, weighing 65,250 pounds on drivers (and it had previously been very hard riding), and I am pleased to say that they have given excellent satisfaction. they having carried the engine without straightening or breaking, and we have had no repairs to make. I would say that the 'V' band is, in my opinion, well calculated for easy riding and prevents the breaking of leaves.

"We have a number of springs in use with the 'V' shaped bands, and I have reason to believe they are going to give better results than the springs with the ordinary bands; in fact, I think there can be no question but what the spring will ride easier, and think they are less liable to break."

The committee on springs, appointed by the American Master Mechanics' Association at their meeting in June, 1888, also referred to the "V" shaped bands in their report, as follows:

"An improvement in engine and tender springs has been brought to the attention of your committee, and one which we think is worthy of your consideration, as it may prove an important factor in the improvement of this class of springs in future; we refer to the 'V' shaped band, shown in Fig. 4, plate 2, a full sized spring of which was on exhibition at the convention. This spring is manufactured by the A. French Spring Company, Limited, and they are prepared to explain its merits to a fuller extent than the space in this report will allow. We understand that the claims are that the bands are wider next to the main plate, and narrower next to the short plates. It is an established fact that the inclination of the main plates is to leave the outer ends of the band in attaining toward a straight line, thus relieving the pressure of the band on the main plate, while the short plates are forced against the bands, rendering them liable to breakage. With less width of band on the short plates, pressure is thus decreased, an easier and increased motion is imparted, and liability of breakage consequently reduced. The cost is not increased, nor the carrying capacity reduced, and a more durable spring is secured. We present the subject as a new idea in the manufacture of engine and tender springs for your consideration."

Two years' service since the date of that report has established the value of the improvement, and the theory at that time has, by practical use, demonstrated its correctness.

The Jewett Supply Co., 101 Milk St., Boston, Mass., have arranged with the Boston & Albany Railway Co., and the New York and New England Railway Co., to fit up some cars with their frictionless car center and side bearings.

The Buffalo Forge Company have sent us copies of a great many testimonials speaking very highly of the Hot Blast process of factory heating supplied by the company. Those who use this system of heating appear to be very enthusiastic in its favor.

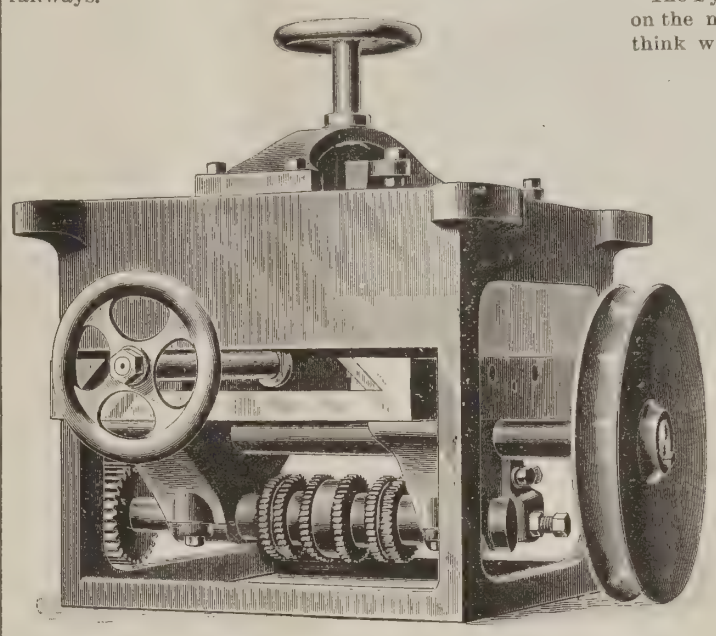
The new buildings of the Egan Company, Cincinnati, O, U. S. A, are fast approaching completion, and in a short time opportunity will be given to bring forward a cherished idea of some years standing: making a departure original and characteristic of the enterprise of this progressive concern. A new department will be reserved for displaying their late improved car builders' machines in practical operation, doing exactly what they are designed to do. This new idea is an innovation that will be of great value to all those who are interested in getting machines to save time and labor, and for doing rapid and perfect work.

The Monongahela House, Pittsburgh, Pa., which was closed for a short time for alterations, has been re-opened under the management of Chas. S. Holmes and H. H. Arnold, who are determined that the Hotel shall be second to none in the State. It has been handsomely re-furnished throughout and is in better condition than ever before. Facing as it does on three streets, it affords a large number of front rooms. It is very pleasantly and conveniently situated, overlooking the Monongahela River, making it cool and pleasant. The Baltimore & Ohio Railroad Depot is exactly opposite and the Pittsburgh and Lake Erie Depot within five minutes' walk, and two lines of cable cars at right angles bring it in direct communication with the Pennsylvania Railroad Depot and all the places of amusement. J. E. H. Kelly, who was connected with it for a number of years, is Manager.

We have received a finely illustrated catalogue of B. F. Sturtevant's steam hot blast and drying and heating apparatus, as applied to drying lumber, etc., and warming buildings. Besides giving very clear illustrations of the diffe ent kinds of drying and heating apparatus, the catalogue contains a great deal of useful information on the subject. In fact, it contains the best essay on the science of drying that we have ever read. Parties interested in the subject may obtain the catalogue by applying to B. F. Sturtevant, Boston, Mass.

Messrs. Schall & King, of Middleton and York, Pa., are busy with an order for a number of coal cars for the West Virginia Central Railway. They are also building a number of cars for South American Railways, to be equipped with the Eames Vacuum Brake.

Billmeyer & Small Co., York, Pa., are very busy in their passenger car department with large orders from railways in Venezuela. They are also building 25 passenger cars for the Norfolk & Western Railroad and several for other railways.



DAVIS' PATENT VALVE PORT MILLING MACHINE.

This machine is designed for milling out ports in valve faces of steam cylinders and it is a very valuable machine for this purpose, duplicating work exactly and in the shortest possible time. It consists of a frame that is of itself a template resting on the seat that the studs are placed in and supports the steam chest; This frame carries another frame, which has two distinct movements, carrying milling cutters that are arranged on a mandrel with space washers, so that the bridges and ports can be all cut to dimensions at one operation; the inner frame is fed down into the cut by the hand wheel and screw shown on top, and is fed the length of the ports by the hand wheel at the end of machine. It is operated by a rope belt similar to that used for driving drills, etc. The machine is much lighter than the cylinder and can be readily placed in position, using the stud holes to attach to, for that purpose. Built by Pedrick & Ayer, 1001 and 1003 Hamilton street, Philadelphia Pa.

A. W. Field late with the Thomson-Houston Electric Co., and formerly General Agent for Frank H. Andrews of New York, is now connected with the American Steel Car Wheel Co., of Boston.

The daily melting capacity of foundry pig iron was increased 1,616 tons during the year 1889 by shipments of 72 "Colliau" cupolas from the works of Byram & Co., Detroit, Mich.

We are informed by the Butler Drawbar Attachment Company that the demand for their device is rapidly increasing, and that the roads that are using it speak very cordially of its influence in reducing the expense of repairs to freight cars. The springs protected by this attachment cannot be wholly compressed, consequently none are broken.

The Gold Car Heating Company provide the means of preventing people from suffering from cold in winter, and realizing the prevailing discomforts of the summer months, they have sent out to their friends a handsome fan. The fan has a double use. It can be used to keep the holder cool, and it supplies amusing reading for those who desire intellectual recreation.

The American Concave Spring Company, 15 Cortland St., New York, has purchased the property of the Concave Elliptic Spring Company; Mr. William Davison, who was connected with the old company, is General Manager. These springs have been in use on a number of railways for several years, and wherever used have made good records.

The following announcement is made of the appointment of Western and Eastern Representatives of the Westinghouse Air Brake Company:

Mr. Jn^. W. Cloud, Western Representative, with office 974 Rookery Building, Chicago, Ill.

Mr. R. A. Parke, Eastern Representative, with office at 160 Broadway, New York, N. Y.

A late decision of the Supreme Court of Illinois held that to overcome the inference of negligence which arises, by force of the Illinois statutes, from the mere fact that damages have been caused by fire from a locomotive engine, it must appear, not only that the engine was provided with the best and most approved appliances, but also that they were at the time in suitable order and repair, and there was no negligence in their use and management.

We have received from Felton, Rau & Sibley, Philadelphia, a small hand book giving facts about fitting and finishing all kinds of hard and fancy woods. Besides giving great deal of expert information connected with filling and varnishing, the book contains beautiful specimens of wood work finished with the varnish supplied by the firm. Parties interested in the use of varnishes can obtain the hand-book by applying to the firm. It will be found very useful. Send for it.

The men who have charge of the Detroit International Fair and Exposition appear to have a proper appreciation of the influence of the press. In a notice accompanying a ticket of admission which has been sent to this journal, they say: Deeply appreciating the influence of the press in helping to make last year's Exposition the success it was, the management will feel grateful for the presence of as many members as possible on this occasion, promising them that the programme will be more interesting than last season, and that no pains will be spared to make their visits enjoyable.

The Pyrogravure Company, New York, are about to put on the market a style of solid wood decoration which we think will become highly popular with car builders. The process makes a beautiful reproduction of the most artistic carving and imparts the richest shadings of the wood, from its natural color to deep brown or black tints, having the effect of fine inlaid work. We have some beautiful specimens of the wood which we will gladly show to parties interested in wood work decorations.

It will, no doubt, interest many of our readers who travel and collect books containing information about foreign countries, to learn that the Association of Commerce and Industry has published a profusely illustrated guide of Geneva, Switzerland, which contains an excellent map of that city and a large amount of information relative to the same and the Swiss industries and educational institutions, historical notes, etc., etc. The book will be sent free of charge upon application to the New World Travel Company tourist and excursion agents, 321 Broadway, New York.

Wm. Sellers & Co., incorporated, of Philadelphia, Pa., builders of machinery for railway shops, are now building for the Baldwin Locomotive Works' new shops two 100-ton high speed traveling cranes, each with two 50-ton trolleys, for a span of about 75 feet and for a shop about 340 feet long. Each crane is to be driven by electric motors on the hanging platform and is to have the following speed per minute: 100 feet and 200 feet on runway, 50 feet and 100 feet on bridge and 5, 10, 20 and 40 feet hoisting and lowering, all variable without shock or jar from zero to maximum, at the will of the operator.

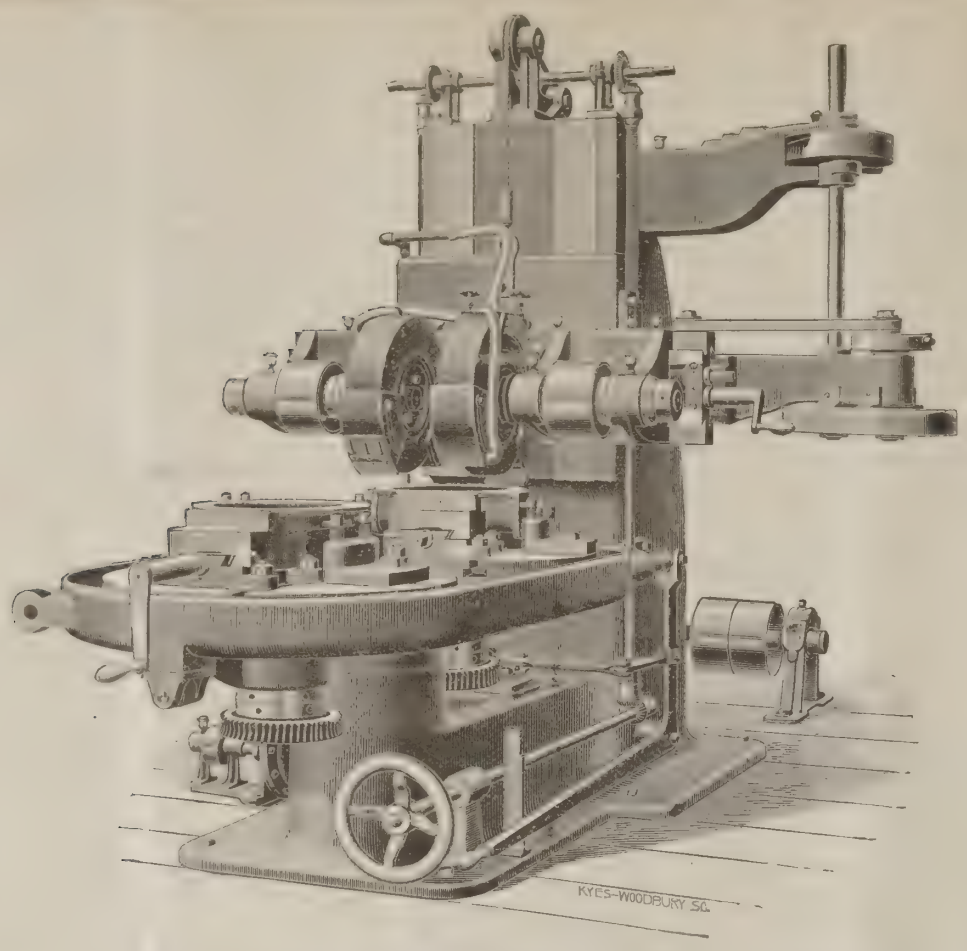
The Eureka Tempered Copper Company moved into new factory in February last at North East, Pa., along line of Lake Shore & Michigan Southern Railroad. The machinery for finishing put in in April. Have trial orders upon nearly all the trunk lines and giving good satisfaction. In fact, all they claim for it. Hon. Wm. L. Scott, one of the directors, represents a large railroad interest and is well known in railroad circles. For machinery bearings, gear wheels and bushings, they have had the best of success and are crowded with orders. A great many firms that have used the hardened copper for bearings write in the highest terms of its good qualities.

The Pintsch Gas Works, recently built by the Safety Car Heating and lighting Company in Boston, are in full operation, supplying gas to the cars of the Boston & Albany, Old Colony, and New York & New England railroads. A large number of additional cars are being equipped with the Pintsch light for these roads. The new equipment for the New York, New Haven & Hartford and New York & New England railroads, "New York and Boston trains," will also use this superior light. The works for the Central Railroad of New Jersey, at Jersey City, are in full operation, furnishing gas to the cars of the Central of New Jersey, and through New York and Washington trains, and the Pullman cars in this line. The works in Atlanta, Ga., are nearly completed. Rapid progress in being made in construction of the works in Cincinnati, St. Louis and Denver.

The Gifford bill lately introduced into Congress is about the most idiotic piece of attempted legislation we ever heard of. It provides for the appointment of a paid board of commissioners whose duty it shall be to compel railroad companies to adopt the use of steel ties. Part of the bill reads:

"The duty of said board shall be to carefully investigate as many patented cross-ties as in their opinion may present durability in service, and then determine upon three of the best types of steel ties and cause 500 of each type to be manufactured and put into actual service in lots of 100 in fifteen different parts of the United States, or whatever road-bed that said board may decide upon, to be tested for two years; that whatever type of steel tie will give the best satisfaction in practical service by said test shall then be considered a standard steel tie, and shall be used by all railroad companies."

No entirely satisfactory steel tie has yet been invented, and it is very doubtful if ever a metallic tie will do so well as the wooden ones generally used. When the increasing demand shall make the use of steel ties more economical than the use of wood railroads will be likely to change their practice, but the traveling public will gain nothing by the change. The wooden tie makes as safe and more solid track than anything constructed from metal, so that legislation has no right to order a change. The measure is evidently promoted in the interests of parties who have patented metal ties that will not command a market on their own merits.



THE SPRINGFIELD EMERY WHEEL CO.'S VALVE SURFACER.

This grinding machine, the patents for which are controlled by the Springfield Emery Wheel Manufacturing Company, of Bridgeport, Conn., belongs to that class in which one or more revolving abrading wheels are arranged to so operate on the surface of the work as to reduce it to a true plane. The abrading medium is composed of two emery wheels of corresponding diameters, which have a common revolving and laterally reciprocating movement and a common vertical adjustment, and in addition each wheel can be independently adjusted both laterally and vertically. The upright arm of the frame is formed with a vertical face of considerable area on which a head block is adapted to move horizontally. On the head block is placed a cross head arranged so as to have free lengthwise movement. This provides for the adjustment of the grinding wheels vertically and horizontally. The lateral adjustment of the wheels is for the purpose of gauging the distance between them according to the width or diameter of the work to be operated upon. while the vertical adjustment is for the purpose of compensating for unequal wear of wheels by slightly depressing the one that wears away most quickly.

The two vertical screw shafts shown at the sides of the frame have right and left threads, and pass through hubs carried by the heads block. On the upper ends of these shafts are bevel gears with which engage similar gears on the ends of a shaft mounted on top of the frame, by means of which the head block and the wheels carried by it can be raised or lowered.

Projecting from near the top of the upper part of the frame is a bracket in which is mounted a vertical shaft driven by a worm and gear, the shaft being splined to the gear and its lower end being mounted in a bracket secured to the head block. On the lower end of the shaft is a gear, meshing with another on the end of a short vertical shaft mounted in the same bracket. The upper end of the shaft carries a crank disk having a crank pin that can be adjusted toward or away from the center. A link connects the crank with the crosshead. The revolution of the worm shaft by suitable belt and pulley will impart a horizontal reciprocating movement to the crosshead and wheel, and the amount of this movement can be changed as necessary by adjusting the crank pin.

This compound movement of the wheels greatly increases the speed of the work, but this result is still further augmented by the revolving movement imparted to the work itself in a plane at right angles to the plane of revolution of the wheels. In the machine here shown there are two work-holding mechanisms, one of which revolves the work under the wheels, while in the other new work is being placed. The short shafts of the tables carrying the work are mounted in vertical bearings formed upon opposite sides of the center of a bed mounted upon a hub of the frame.

The bed is so formed that the water used for wet grinding is led to a reservoir in the frame. Upon the upper surfaces of the tables are clutches for holding work. Upon the lower ends of the shafts of the tables are worm gears. When the bed is turned to bring one of the tables under the abraiding wheels its worm gears engage with a worm shaft provided with a driving pulley at its opposite end. This shaft is so mounted that its worm end may be moved so as to disengage the worm from the gear and permit the turning of the bed. Provision is made for locking the bed in place with one or other of the tables under the wheels.

This machine is designed for graining the annular bearing surfaces of valve bodies, and other similar circular work in which the wheels operate at diametrically opposite points, but it is adapted to operate equally well upon flat surfaces.

The Kingston Locomotive Works Company has sold five locomotives to the Canadian Pacific, one to the Quebec & Central, and one to the Northern Pacific & Manitoba. This company has numerous other orders on hand.

Growth of the Yale & Towne Works.

A local paper, in writing up the history of the Yale & Towne Manufacturing Company says: The original building (now known as the "Old Lock Shop") was about 35 × 120 feet with a one-story annex at the east end, 35 × 45 feet, which constituted the brass foundry and boiler room. A small addition (the present shipping shed) was made about 1872 to accommodate post-office wood-work, and in 1873 a new foundry building was erected, which has since been utilized for the engine room. In 1875-1876 the South wing of the present pulley block shop was erected, additions thereto being made during the next two or three years, until the whole of the present building was completed. In 1881 the growth of the business was such as to necessitate a large increase of capital and a large extension of plant. A considerable portion of the new capital then issued was taken by employés and others, as was also the case with subsequent issues, so that the company now has numerous stockholders. During the summer of 1881 the range of buildings fronting on Pacific street, and also the present foundry building were erected at which time also the present steam plant was installed. The west end of the post-office building had been erected a short time before, and the eastern extension thereof was built during the summer of 1882. In 1883 the growth of the business compelled a further extension, and during the summer of that year the present crane shop and smith-shop buildings were erected. At the present time plans are in preparation for a new building east of the present smith shop to accommodate pully block and chain making, the building now occupied for these purposes being required for use in connection with the small lock department. Plans are also under consideration for a large extension of the foundry building. The number of employés has increased steadily from thirty in 1869, to over eight hundred at the present time, exclusive of those employed at the branch houses of the company in New York, Chicago, Philadelphia and Boston.

A dispatch from Portland, Me., says: A large deal in business circles was closed here to-day. John L. Whiting & Son, of Boston, the largest brushmakers in the world, have purchased the entire stock and good will of D. White & Sons, of Portland, the oldest brushmakers in the world, and the second in extent of business only to John L. Whiting & Son. The purchase includes, beside stock, all the machinery of the plant here, and the right to manufacture and stamp brushes with the well-known name of D. White & Sons. John L. Whiting & Son will remove the plant to Boston and do all their manufacturing there in the future, sending their goods to all parts of the world. They have a branch office in Chicago and a large business in that section.

The Capitol Manufacturing Company write us: "We beg to call attention to the fact that we have recently filled orders from the following prominent houses: Pittsburgh Locomotive Works, Pittsburgh, Pa.; Westinghouse Air Brake Company, Pittsburgh, Pa.; Minerva Car Company, Minerva, O.; U. S. Rolling Stock Company, Hegewisch, Ill.; Chicago, Milwaukee & St. Paul Railroad, Milwaukee, Wis.; Northern Pacific Railroad, St. Paul, Minn.; Chicago, Burlington & Quincy Railroad, Aurora, Ill.; Pacific Central & St. Louis Railroad, Cincinnati, O.; Kansas City, St. Joseph & Council Bluffs, Kansas City, Mo.; Kansas City, St. Joseph & Missouri Railroad, Springfield, Mo., and a great many others. The demand for this class of machinery is steadily increasing, and we have found it so difficult to keep up with orders that we have been obliged to increase our already increased capacity."

Over the Chesapeake & Ohio.

The passenger department of the Chesapeake and Ohio claims that this road is an ideal tourists' route, affording greater variety of scenery and all varieties in their most perfect form, than can elsewhere be found in a journey of similar length. A trip over the line between Cincinnati and Washington, or Old Point Comfort, at this time of the year will convince any one that there is abundant ground for the above assertion, as there is scarcely an uninteresting view from one end of the road to the other. Along the Ohio from Cincinnati to Huntington, the river on one side and the blue hills of Kentucky on the other form a charming landscape which serves to prepare the traveler for the rugged mountainous views which are to be seen further east, such as Kanawha Falls and Hawk's Nest, and in fact all along the New and Greenbrier rivers from Charleston to the famous White Sulphur Springs. The wild and picturesque Alleghanies are left behind only to find as charming views of a more cultivated character among the hills of the Blue Ridge, those from the vicinity of Afton being particularly fine. East of Charlottesville the tourist is compensated for whatever is lacking in picturesqueness, compared with what has just been passed, by the historic interest which is part of the Old Dominion.

Our Directory.

Baltimore & Ohio.—E. Dickinson has been appointed general superintendent of the divisions west of the Ohio river.

Boston & Maine.—D. W. Sanborn has been transferred as superintendent of the Southern division, succeeding W. F. Simons.

Chattanooga & Lookout Mountain.—Wm. T. Ryan, formerly of the Nashville, Tenn., shops of the Nashville, Chattanooga & St. Louis, has been appointed master mechanic of this road.

Chattanooga, Rome & Columbus.—Wm. H. Price has been appointed purchasing agent, with office at No. 9 Pine street, New York, vice G. W. Ettenger.

Chesapeake & Ohio.—J. D. Hoban has been appointed assistant superintendent of the Huntington Divison, with headquarters at Clifton Forge, Va.

Chicago, Burlington & Northern.—John R. Hastings has been appointed general superintendent of the road, with headquarters at St. Paul. The office of general manager has been abolished and the jurisdiction of the general superintendent will be extended over that department.

Chicago, Rock Island & Pacific.—W. I. Allen has been appointed assistant general manager, with headquarters in Chicago. W. C. Page has been appointed assistant superintendent of the lines west of the Missouri River.

Cleveland, Cincinnati, Chicago & St. Louis.—Mr. J. H. Garaghty, purchasing agent of the Columbus, Hocking Valley & Toledo, has been appointed purchasing agent of this road. His headquarters will be at Indianapolis, Ind.

Evansville & Terre Haute.—F. S. Dodds has been appointed superintendent.

Fort Wayne, Cincinnati & Louisville.—D. S. Hill is general superintendent and T. H. Perry purchasing agent of this road.

Minneapolis, St. Paul & Sault Ste. Marie.—E. A. Williams has been appointed to succeed T. A. Fraser, resigned, as master mechanic.

New York Lake Erie & Western.—C. P. Weiss, general foreman of the shops at Susquehanna has been appointed master mechanic at Rochester.

New York, Ontario & Western.—A. C. Caryl has been ap pointed assistant superintendent, with charge of the Carbondale and Scranton division.

Northern Pacific.—Angus Brown, master mechanic, has been transferred from Glendine to Livingston, Mont. George W. Gardner is appointed master mechanic at Glendine.

Pennsylvania.—A. C. Hippey has been promoted from the Altoona division to the position of general superintendent of the Norfolk and Western division. L. K. Lodge has been appointed superintendent of the Altoona division, R. J. Holliday has been appointed superintendent of the Central division, and A. W. Moss has been promoted to superintendent of the Lewiston division. W. Beardsley has been appointed master mechanic of the Fort Wayne road, at Allegheny, vice G. J. Parkins, resigned.

Rio Grande Western.—W. H. Bancroft, general superintendent, has resigned.

South Atlantic & Ohio.—Geo. H. Graves has been appointed superintendent, to succeed John Jenkins, assigned to other duties.

St. Louis & Hannibal.—Richard Whalen, master mechanic, has resigned, and Mr. Handley has been appointed to the position.

Tampa & West Key.—D. F. Jack, general manager, and A. S. Russell, purchasing agent, have resigned.

Tuckerton.—John C. Price has been appointed superintendent.

Union Pacific.—J. W. Griffiths has been appointed general purchasing agent. A. H. Crocker has been appointed superintendent of the Pacific division, with headquarters at Portland, Ore., vice Mr. C. W. Johnson, resigned.

Employment.

Wanted.—Competent locomotive draughtsman. Apply, stating salary required and giving references to S., National Car and Locomotive Builder.

Wanted.—Situation as Foreman Boiler Maker and Sheet Iron Worker, having had 20 years' experience on locomotive and stationary boilers. Best of reference given; 13 years now with my employer. Address S. J., Care National Car and Locomotive Builder.

Wanted.—Position as master mechanic in charge of motive power or car departments, by a thorough mechanical engineer; has been connected with leading locomotive and car works, and railways, as machinist, mechanical engineer, master mechanic and master car builder for past 20 years. Member American Master Mechanics' Association. 36 years of age; at present connected with leading western railway. Experienced in organization and management of machinery departments, operating accounts, etc. Temperate, energetic and reliable—best of references. Address X. Y. Z.

Care National Car and Locomotive Builder,

NATIONAL CAR AND LOCOMOTIVE BUILDER

SEPTEMBER, 1890.

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The Norfolk Southern have two first-class coaches under way at the Delaware Car Works.

Jackson Sharp Company has recently closed a contract with Richmond & Danville for 24 new first-class coaches.

The Columbia & Puget Sound is having 50 new coal cars, each of 10 tons capacity, built at its shops at Seattle.

The Georgia Midland & Gulf has recently placed orders for 100 ventilated cars, 30 other freight cars and two passenger cars.

The Wagner Palace Car Company has begun the building of ten new sleeping and six drawing-room cars at its Buffalo shops.

The Erie Car Company are making the first deliveries to the Central Vermont on the lot of 500 freights for the "Ogdensburgh Line."

The Cincinnati, Hamilton & Dayton have placed orders for five more locomotives, divided, we believe, between Rome and Schenectady.

The first installment of the 1,000 car lot from the Erie Car Works for the New York & New England Railroad have just reached Newburgh.

The Kingston Car Works delivered 10 platform cars to the Intercolonial last week, and are building a large number of others for the same road.

The New York, Lake Erie & Western has completed a new pay car at its Buffalo shops for the Eastern lines. The car has an observation room at one end.

The Cincinnati, New Orleans & Texas Pacific have placed an order with Pittsburgh Locomotive Works for 15 engines. Three of the number are for passenger service.

The Rhode Island Company have taken an order from the New York, Providence & Boston for a couple of duplicates of those locomotives built last winter from Mr. Butler's specifications.

The Chicago, St. Paul & Kansas City has placed an order for an entire new vestibule passenger equipment for its limited trains between Chicago & St. Paul, and also on its new line from Chicago to Kansas City.

Mr. Lander, of the Old Colony, has issued orders for the building in his own shops of six engines of his standard type of eight-wheel locomotives. The compound is still under way and will be launched this fall.

The Automatic Interchangeable Car Coupling Company is equipping 100 cars for the Burlington, Cedar Rapids & Northern with the Fox coupler. A number of Northern Pacific cars are also being equipped with the device.

The Baltimore & Ohio directors have decided to approve the agreement between the city of Cumberland and the Baltimore & Ohio Railroad Company for the new yards and locomotive repair shops so be established at that city.

The government of New South Wales has decided to invite applications in Great Britain, America and Australia for the position of engineer-in-chief of the New South Wales railways. The position is worth about $8,000 a year.

The New York & New England have received four of their lot of 10 engines, and they are being rushed in service to meet the great and pressing demands on the motive power department for power to move the unusually heavy business.

Officers of the Union Pacific report that owing to an unusually heavy volume of business the road has been inconvenienced through scarcity of power. They have in course of construction no less than 131 new locomotives, but delivery is slow.

The Grand Trunk has just received five new Pullman cars for the line between Chicago and Boston. Each car has 12 sections, drawing room, smoking room and buffet. The cars are lighted by the Pintsch gas system. They are finished in mahogany and upholstered in blue and gold. They have a library of a couple of hundred volumes.

The steamers "City of New York" and "Teutonic" made remarkably quick passages across the Atlantic lately, and both vessels were said to have been in sight of each other most of the time. Steamship companies assert that there is no racing between steamers. We have not heard what new word they use to describe the attempts of two steamers to get there first.

Three locomotives belonging to the Kings County Elevated Railroad of Brooklyn, that were damaged in collisions, were sent to the Rhode Island Locomotive Works to be repaired, and the intention is to compound one of them for trial. If on a fair trial of train service the engine is found to work with decided economy, the others will be put up in the same way. The first engine will be ready in a few weeks.

Our English exchanges inform us that American engineers are at present interesting themselves in the question of two lookout men on their locomotives. People must often go abroad to learn the news about their own household, but we would like in this instance to find out the particular engineers who are interesting themselves on the question. We suspect it will take a good deal of "interesting" before action ensues.

A Western paper's definition of the term volt: "The volt gives one blow of a specified force. As volts are added together the force of the blow is increased until the endurance limit is reached. It takes about 25 volts to make a perceptible tingling sensation. When 50 volts pass through the body the tingling sensation becomes unmistakable, but not strong, while 100 volts feels lively, 200 volts strong, 300 volts powerful, 400 volts Titanic, and 500 volts will knock a man flat."

Every passenger conductor on the Louisville, St. Louis & Texas has been dismissed, and the places of the discharged men have been filled by promoting freight conductors. It is not known definitely whether the freight conductors are working at lower wages than the men whose places they have taken, but it is not generally believed that economy was the motive for the change. No explanation has, however, been made by the officials of the line. "Knocking down" is whispered as an explanation of the movement.

There is nothing in the world so like a Texas steer as a freight car when it (the freight car) takes a notion to go on a rampage. Recently the Mexican International bought a lot of freight cars in Chicago to be sent to Mexico; permission was given to load these cars on their way down. Two of them went astray, and after two months' hunting they were found at the other end of the continent. They had been reloaded at St. Louis and sent to Bangor, Me. There is no counting on a box car when it gets loose.—*Western Railway.*

A Chicago firm that was prosecuted for violation of the city smoke prohibiting ordinance put the blame on their engineer, and the recommendation was made that his wages should be reduced. We have a strong suspicion that the trouble was caused by the engineer's pay being previously too low for the employment of a first-class man. It is the cheap man who calls himself an engineer, and is really a begrimed hodman who raises sufficient smoke to poison a city and keeps life constantly in jeopardy by running the boiler contrary to nature's laws.

The danger of railroad crossings at grade has at last sufficiently impressed the people and the railroad companies in Chicago to induce them to consider the question of elevating the tracks. This is an encouraging sign. The Pennsylvania Railroad has set and is setting an example in this matter in a number of cities through which it runs, that ought to impress other corporations with the gain to themselves which would follow the taking of a like step. If it pays one company to raise its tracks, increase its speed, and stop killing people, why will it not pay others?

During the Grand Army reunion all New England roads were taxed to their utmost capacity, and that they should have handled this enormous traffic—spasmodic and varied as it was, without the loss of a single life, is indicative of excellent organizations and level heads. A hint only of this is shown by the fact that the New England Railroad on two separate days ran 13 trains on one schedule. In all it is safe to say they had on an average of thirty special or extra trains per day, all loaded to the brim with human freight. How this traffic must have taxed the operating departments, particularly the train despatchers, can only be appreciated by one who has "been thar."

We have received from Mr. Gotthold Sanger, Trenton, Mo., description and illustration of a device for regulating the admission of air to locomotive fire-boxes, the need of whic he says was suggested by reading "Combustion n Locomotive Fire-boxes," by Angus Sinclair. The admission of air above the fire is regulated according to the times of firing, and takes place through tubes wh·ch remain open until the hydro-carbons in the coal are expelled. The inlets to the tube are opened and closed by slides operated b a steam cylinder and suitable connections. The opening and closing are done automatically. The closing of the fire-door puts the device into operation, and it performs the movements of opening and closing the ·lides without attent·n from the firema . The device has been app ied to a locomotive belonging o the Chicago, Rock Island & Pacific Railway.

During the discussion on brick arches in the last master mechanics' convention, some one drew attention to the annoyance from the flue sheet getting incrusted with clinker when some kinds of coal are burned in fire boxes having the brick arch. Trouble of the same character was experienced on European railways in the early days of the brick arch but some means was found to prevent the clinker forming. If any of our readers can give us information of what the remedy was they would confer a favor on many railroad men. The incrustation often covers up part of the flues completely and is very detrimental to the steaming of engines affected. The same coal does not incrust the flue sheets of all locomotives having the brick arch, so it is probable that close observation of the engines that escape the trouble might lead to the discovery of the remedy. The clinker is a silicate of lime and is exceedingly refractory.

There is a very enterprising lapidary at Old Point Comfort. By some means he manages to make visitors to the resort believe that good mineral gems may be found among the gravel on the beach. The visitors who have plenty of leisure find the looking for moon stones and topazes a pleasant pastime. They pick up various kinds of pebbles, mostly quartz crystals, and take them to the lapidary for his expert opinion. In most instances the stones are declared gems and the enterprising artisan offers to cut them for a small sum. And the visitors come away happy in the possession of treasures of their own collection. During the meeting of the railroad associations the lapidary pretended to have cut more stones than ten men could have done in a month. The gems passed off upon people as their own findings are cheap specimens cut in Europe. They are bought by the bushel in John street, New York for this particular business.

A peculiarity about the numerous strikes that are constantly taking place among railroad men is that there is no complaint made of the hours of labor and the wages paid. The causes of dispute generally turn on the men not being permitted to manage the railroads they work for. The arbitration that calls for a settlement of a dispute is really the request for outside parties to decide whether or not the railroad companies shall manage their own business. The *Interocean* of Chicago puts the case very clearly in an editorial, which says: "There are a good many things which could with propriety be submitted to arbitration. Nearly all questions of a general nature, such as hours of labor and rate of compensation for a given kind of service, but when it comes to the discharge of an individual employé for cause, that is not a matter for arbitration. If the employé has a time contract he can enforce payment for all the time covered by the contract, no matter whether assigned to duty or not; but when both parties are at liberty to terminate the engagement without previous notice there is no room for calling in the good offices of an umpire, unless the cause of the discharge is in itself general."

The Delaware, Lackawanna & Western has received part of the new vestibule cars which the Pullman company is building. The cars received are two parlor and two baggage cars. They are painted the standard color, dark green, the baggage cars being decorated with gilt scroll work. The interiors of the parlor cars do not differ materially from the general run of that class of cars built by the Pullman company, excepting that the smoking room is reached from the aisle by two doors at right angles with each other and is entirely closed off from the main body of the car. The chairs and settees throughout are covered with white hair cloth instead of plush, which can be easily wiped off and kept clean. The baggage cars have brass fixtures for the use of lamps, while in the parlor cars the gas fixtures of the Pintsch system have been put in. The gas is obtained from the plant of the Safety Car Heating and Lighting Company on River street, Hoboken. The Gold system of steam heating, similar to that in general use by the company, is used. The trucks have each six 36-inch paper wheels, made by the Allen Paper Car Wheel Company. The six-wheel brake application adopted by the Pullman company is used.

A Ramble through Altoona Shops.

FIRST IMPRESSIONS.

The workshops belonging to the Pennsylvania Railroad Company at Altoona, Pa.; are the most famous in the world. Nearly all railroad mechanical officers are more or less familiar with the great industrial establishment at Altoona, and many are ready to criticise divers methods and practices of the place, but those who have enjoyed the opportunity of carefully and conscientiously examining the works, invariably go away impressed with the magnitude of the operations carried on and of the highly perfected system under which they are conducted.

A part of the Pennsylvania system which is habitually assailed by the motive power department officers of other roads is the arrangement which places running engines and the men who handle them entirely within the control of the operating department. This system is an unqualified success as worked by the Pennsylvania Railroad Company, but other companies that adopt the plan generally find that it works unsatisfactorily. The cause of the difference probably is that the Pennsylvania people are exceedingly careful to promote to the position of superintendents practical men, who are nearly always thoroughly competent to perform the varied duties devolving upon them. Being for a few years stenographer to an executive officer is not here considered sufficient training for a superintendent.

THE PENNSYLVANIA "SYSTEM."

Altoona is the mechanical headquarters of the whole Pennsylvania system and the principal manufacturing establishment for the company. The general superintendent of motive power, whose office is here, exercises supervision in regard to standards and matters relating to uniformity of rolling stock not only for the Pennsylvania Railroad Company, but for all the proprietory lines. As, I understand it, he with his superintendents of motive power and their assistants design and build or arrange for building all locomotives and cars, and when the rolling stock is ready for the road it is transferred to the charge of the general superintendent who, through his division superintendents, distributes the locomotives and cars according to the requirements of the traffic. The motive power men have nothing to do with an engine or car after it is turned over to the general superintendent until it is sent in for repairs, and an official under the general superintendent decides when it is necessary to take an engine or car into the shop. The men handling the locomotives are not any more under the control of master mechanics than conductors are. The road foreman of engines is the trained mechanical officer who exercises authority over the enginemen. He is invariably a competent man, and interests himself in seeing that the men working the engines understand their business and attend to it. This arrangement permits the mechanical officers to devote all their attention to the best and most economical means of designing, building and repairing locomotives and cars.

The superintendent of motive power appears to operate from his office through three branches. First is the division of the mechanical engineer, who supplies all drawings and designs and originates all work; second, the division of supplies and stores, which controls all material; third, the accounting department, which records all expenditures of money.

After an engine or car goes out of the shop it is attended to by the road foreman of engines and the chief inspector respectively. Both these officers are under the superintendent, but they are required to report to the superintendent of motive power on matters of a mechanical nature. Business relating to discipline and personal matters is reported to the superintendent. The master mechanics, roundhouse foremen, and car inspectors perform their duties relating to repairs under authority of the superintendent of motive power, and in their dealings with the men under them they are responsible to the superintendent. The master mechanics and other officers working under the system speak well of it. There is seldom any grievances heard of among the enginemen on the Pennsylvania lines, so it may be presumed that they like the working of the system, for enginemen are not given to concealing their hardships.

SHOP MANAGEMENT.

It is not my intention to attempt giving an elaborate description of the Pennsylvania system or even of the shops at Altoona, for a whole number of the NATIONAL CAR AND LOCOMOTIVE BUILDER might easily be filled up with what is to be seen in the works alone. During the course of a day spent in the works, I was able only to walk slowly through portions of the leading shops, and I found the ramble highly interesting, although it was performed on the hottest day of the season, and Altoona is the most stifling spot in Pennsylvania when old Sol is on the rampage. A great many shop alterations and improvements are in course of execution, yet the place is maintained in a wonderfully orderly condition, and compares most favorably with some large railroad establishments I had visited abroad within a year. One receives the impression at Altoona that the men managing the establishment, besides being highly progressive and wide awake, have learned the rarely revealed secret of how to make alterations in shop tools and arrangements without paralyzing a portion of the works.

THE PIECEWORK SYSTEM.

While going from shop to shop, I kept in mind the fact that in this establishment the system of remuneration by piecework on rolling stock repairs originated and was thoroughly developed. Practically, all the work done is now paid for on the piecework system. After watching the effect on the workmen of paying by the quantity of work done, I could see very little difference from what is to be noted in the ordinary railroad shop, except that there was very little loitering to be seen. The workmen are reported to be better satisfied with piecework than with the per diem plan, as it enables them to make better wages. The company get their work done at a lower cost and obtain greater output from their plant, so it looks as if the only parties having reason to complain are the incompetent workmen and the man who is chronically tired and fond of resting himself over his work.

Many railroad men who are not familiar with the working of piecework on repairs cannot understand how the basis of payment is equitably arranged, but those who are engaged working under the system appear to experience little difficulty. The greater part of repair jobs are repetitions of what had been done previously. A job will sometimes turn out more difficult than usual, but others are more easily performed than the average, and so the hard and the easy conditions tend to make a fair average. When something happens to make a job particularly difficult provision is made for paying according to the labor involved.

IN THE MACHINE SHOP.

They are exceedingly busy in the machine shop mostly with repairs, but they had some fine new "class O" engines under construction when I was in the shops. The engines are built for heavy fast passenger service, and are as handsome in appearance as they are efficient in service. The boilers of these locomotives interested me more than anything of the boiler maker's art that I have seen for a long time. Indeed, I consider it the finest locomotive boiler I have ever seen. The boiler has a shell 57 inches diameter and a Belpaire fire box six feet long, admirably stayed in every direction where strains have to be resisted. As we intend illustrating this boiler soon, it is not necessary to go into details of its construction.

The machine shops have exceptionally good facilities for handling material and finished work. They have a method of grouping the tools here that is not followed in many railroad shops, but which is a good plan for diminishing the need for moving material about the shop. The usual grouping plan is to have all the heavy lathes in one section, the heavy planers in another, and so on. Here the tools necessary for finishing a particular job are placed in convenient proximity and in the way that admits of easy transition while the various operations are performed. Thus the wheels, cylinders, frames, etc., are finished in spots assigned to each and not dragged through the whole shop. In the wheel finishing department, I noticed a very convenient pneumatic lift for handling the wheels. Another special tool in the same place was a key seat milling machine made out of an old planer. The axle stands lengthwise on the table and a milling cutter rigged on the head cuts the seat. They lacked an attachment I once saw on a key seat cutting machine of the improvised order, which fitted into the seat that was cut and held the axle in the proper position for cutting the next seat at right angles with the first one. There are some milling machines in the shop designed by Mr. Davis, one of the workmen, and made by Pedrick & Ayer, which are great favorites. A machine that is a favorite in a shop run on piece work is certain to have valuable features. They have in operation a modification of the spur cutter milling machine used for cutting the ends of bridge beams. The cutters are set in two heads that stand parallel and are used for finishing articles with parallel sides. They were finishing driving boxes on it when I was there, but it did not strike me as an improvement on the planer for that particular job.

The practice of casting both eccentrics in one piece appears to be largely followed here. It makes a fine substantial job and produces eccentrics that are secure on the shaft, an improvement that is badly needed on some roads.

IN THE BOILER SHOP.

They are fitting up a new boiler shop with the best appliances in use for producing good boilers at the least cost, and the appearances are that they will have the best boiler shop in America. They have already an excellent hydraulic riveting plant in use, and the work turned out is exceptionally good. They have been experimenting with a very ingenious pneumatic caulking tool made by the American Pneumatic Tool Company, New York. The caulking tool is operated by a piston working inside a light cylinder that can be handled easily. The piston reciprocates with great rapidity and the tool strikes a light blow which is, however, sufficient to make a good job of caulking straight seams.

THE LABORATORY.

I enjoyed a very pleasant visit to the laboratory and was most courteously treated by Dr. Dudley, the head of this most interesting department. As I intend devoting an entire article to the Altoona laboratory in the near future I shall merely glance at the subject now.

This was the first railroad laboratory established and all others have been instituted owing to the successful work done here. There is little difference of opinion now among the more intelligent class of railroad men as to the value of a laboratory where the character of the goods purchased by the company can be submitted to scientific tests. When the first move toward forming the laboratory at Altoona was made nearly all railroad officers looked upon the scheme as an impractical fad, and it was only through a few of the leading officers of the Pennsylvania Railroad having faith in the usefulness of the work to be done that it was persisted in. The special ability and aptitude for the work displayed by Dr. Dudley contributed in a great measure to the successful development of the railroad laboratory, and were doubtless the means of attracting the necessary support to the institution during its infancy.

Wherever properly organized laboratories are in use in connection with railroad works they have been the means of effecting important direct savings to the companies; through the effectual check their work puts upon the supply of inferior material. They also indirectly tend to prevent the class of accidents that so frequently happen from the use of inferior material, and the experts employed soon find out the real value of worthless appliances often crowded upon railroad companies under the pretense that their use will effect great saving.

When I was in the laboratory Dr. Dudley was making tests of compressible substances, such as cotton waste, cushion filling, mineral wool, etc. The tests were made to find how finely the material supplied was subdivided. As substances of this kind are bought by weight, and as volume is the important quality, the manufacturer who supplies a heavy article is liable to get ahead of the man who supplies a lighter and therefore a better article. In the matter of mineral wool, for instance: A certain space in a car has to be filled up with this substance. It is found that the mineral wool made by one manufacturer is more than twice as heavy as that made by another when compressed into a cubic foot of space, yet the light wool is the better nonconductor. By an ingenious arrangement of compressing a given weight of the wool under a certain pressure of water Dr. Dudley ascertains the relative packing value of different samples of the material. The practical result of the method is that 1,200 pounds of mineral wool is used to make a better packing for the floor of a car than 3,000 pounds of less sub-divided material did before.

They were making interesting tests of axles made of various qualities of steel and iron. They turned down the piece to be tested to .635 inch diameter and 10 inches long. A weight of 75 pounds was then hung at the end and the piece was revolved, means being provided for measuring the deflection and counting the number of revolutions. One that had been tested to destruction before I was there stood during 728,000 revolutions.

A curious effect of the tests made in the laboratory has been the reducing of complaints about material. A common practice was for an engineer to say that he had trouble with bearings on account of bad oil, or a painter would say that the material supplied to him was of bad quality. Complaints of this kind were always investigated and the material tested with the result that the blame was placed where it belonged. No one now complains about material unless it really is at fault.

THE MECHANICS' LIBRARY.

They have a fine library, reading room and lecture rooms in connection with the Altoona shops. The institution is in charge of a society of which Dr. Dudley is president. He takes a very deep interest in the prosperity of the library and is laboring very successfully to make the collection the most complete railroad library in the world. It is now undoubtedly the best collection of books in this country relating to railroad subjects. Any of our readers having rare railroad books that they feel inclined to part with ought to send them to Altoona.

THE PAINT SHOPS.

They have lately finished the erection of new passenger car paint shops here that are the finest and best-equipped buildings for the purpose that I have seen. There are five shops side by side under different roofs, each shop having four tracks capable of holding two cars. The shops are very finely lighted from the roof, the ample skylights with double sashes extending the whole length of the shop. All the shops have fine concrete floors, with drainage pits covered with iron grating at each side of the tracks. There is a good supply of hot and cold water available at all points. The Sturtevant system of heating is used and arc and incandescent electric lights are provided for night work. There are iron columns between each line of track for supporting platforms, which can be set at any desired height, on which the workmen stand. The incandescent electric lamps are attached to flexible wires, by which the workmen can place the light at any desired point. The shops stand parallel with each other, and are served with cars by means of a transfer table operated by an electric motor.

Nothing seems to have been omitted that could be devised to make the shops light, airy, warm and clean. The foreman appears to apply the personal equation to good

purpose in making the shops fulfill the full end of their design.

THE CAR TRUCK SHOP.

When I talked to Mr. Wallis, superintendent of motive power, of my desire to see as much as possible in the short time at my disposal, he said, "do not fail to see our car truck shop." From his remarks, and what other officers said, I inferred that the Altoona people took a good deal of pride in their truck shop. On reaching it, I did not find a very imposing place, but after spending half an hour looking at the work going on I concluded that it was well worth a visit. The shop is about 100 feet square and has been fitted up with every appliance that could facilitate the building of trucks from the rough iron. Every operation connected with the work is aided by all the special machinery that ingenuity could devise to finish it quickly and accurately. The success attained may be understood from the fact that 24 men, mostly skillful laborers, build and finish 60 freight car trucks a day. It is not merely that they put the manufactured parts together. They take the rough bars, cut the lengths, form them into shape and drill the holes, do all the drilling and riveting on the channels, take the rough journal boxes, grind the faces and fit on the lids; in short, do all the manufacturing and then fit the parts together, producing the truck ready to go under a car.

The special machinery that enables each man employed to make and finish two and a half trucks a day comprises presses that form the bars at one squeeze, drill presses that drill all the holes at once in arch bars, channel bars and castings. A Sellers hydraulic riveter and accumulator, an Allen riveting machine and various forms of special grinding machines. Among the latter is an emery wheel whose grinding surfaces are at both ends of a cylinder. This is used for facing the lids of journal boxes and a box is automatically traversed across the face of the wheel. One man attends to the two boxes regulating the work at once.

The whole work of truckmaking appears to move automatically, every man in the place pushing forward his own part. Each man is constantly performing the same recurring operations, and he is wonderfully skillful in doing them. This is the only case of manufacturing rolling stock parts that I have watched which closely resembles the systematic methods of manufacture followed in sewing machine works and similar places, where exact reproduction of parts has led to exceedingly expeditious methods of manufacture.

FREIGHT CAR REPAIR SHOPS.

The next place gone over was the freight car repair shops, which is a 40-stall round house with a turn table in the middle 115 feet in diameter and operated by steam. There is nothing special to say about the method of doing repairs except that the draft gear of this road appears to send many cars to the shop. This may be accounted for by the heavy locomotives used for handling trains on the mountain grades.

The superintendent of motive power receives daily reports of the number of cars reported for repairs at the various stations, and he regulates the work to be done at the different shops. The capacity of the shops and the calls made upon them may be judged from a report I saw, which showed that 649 cars had been repaired that day, distributed as follows: Tyrone, 47; West Philadelphia, 81; Harrisburg, 141; Altoona, 209; Blairsville, 13; Pittsburg, 158.

THE NEW LOCOMOTIVE BUILDING SHOPS.

They have lately finished the erection of fine shops for the building of new locomotives, and the tools are being put in under the supervision of Mr. H. D. Gordon, who was for years master mechanic at Wilmington, Del. The buildings are substantial brick structures, well arranged for convenience in handling work. They will be equipped with the best tools in the market.

There were many parts of the works that I had not time to go near. These I expect to write about when I get to the place again, and it may then be of interest to enter into the details of the official organization under which the works are so admirably managed and operated. A. S.

Some Wrinkles.

Mr. Foster, of the Fall Brook Coal Company, has a method of lining cylinders that practically makes a new cylinder for $25. When the cylinder is bored out for the last time, instead of working it in that condition, a cast-iron lining $\frac{3}{4}$ inch thick is slipped in. The lining strikes the edge of the bore at the back port and thus forms a counterbore. The front end is held by the front head and has the port cut out of it, so that no fastening is required. This makes the diameter of the cylinder $1\frac{1}{2}$ inches smaller than the last boring, and about $\frac{3}{4}$ inch smaller than the original size.

The same gentleman has a way of wearing out the brasses of solid end side rods for a second time. When they begin to rattle, he takes them out and turns off the outside, pressing on a band to keep them up to size. This pressing contracts the inside hole without distorting it, so that it fits the pin and can be used again.

No calking is done on the Fall Brook tender tanks. A piece of brown paper is riveted between the sheet and the angle iron and there is no trouble from leakage, while the tank costs less.

On the Cincinnati, Sandusky & Cleveland, Mr. Porter uses false rubbing plates between the foot plate and the tender buffer. These rubbing plates are made of chilled cast iron and drop into sockets provided in the buffer castings, so that when they become worn they can be easily replaced at almost no expense.

Most pits are now made with crowning bottoms, which provide ample and rapid drainage and give the workmen a dry place to stand upon at all times. Those who have nothing but flat-bottom pits would find increased comfort and economy in the crowned floors.

Empty oil barrels are usually considered to be empty, and returned as such. But Mr. Porter sends his empty cylinder oil barrels to the shop engine room where they are filled with hot water. The oil with which they are saturated is drawn from the pores of the wood and then taken from the surface of the water after it has cooled. In this way oil enough is obtained to supply the shop engine and also half that required by one engine on the road.

GULF.

New Erecting Shop at Baldwin Locomotive Works.

Work has been begun on an extension of the erecting shop of the Baldwin Locomotive Works, which, when completed, will give greatly improved facilities for the work of erecting and do much to relieve the pressure for space in other shops. About the middle of July title was secured to 76 small properties, in addition to 9 previously acquired. These houses cover a space of about 230 by 208 feet, or somewhat more than an acre, adjoining the present office and erecting shop buildings.

The present office building, corner Broad and Spring Garden streets, is extended westward 47 feet 9 inches. This addition will give a drawing room and office each 169 feet long by 32 feet 6 inches wide. The present office will be rearranged and a passenger elevator added.

The present erecting shop will be replaced by the new building which will be $336\frac{1}{2}$ feet long by $158\frac{1}{2}$ wide, one story, or 42 feet clear height to base of rafters. The floor of this shop will be occupied by tracks to accommodate 64 locomotives, there being 16 tracks, holding four engines each. At a height of 28 feet will be placed two traveling cranes building by Messrs. William Sellers & Co., Incorporated, which in some respects will be unlike any others yet built. They are each to be of 100 tons capacity, with a span of 74 feet 8 inches and 336 feet run, and are to be driven by electricity. The maximum speed of the bridge travel will be 200 feet per minute; trolley travel 50 and 100 feet, and the main hoist speeds 5, 10, 20 and 40 feet per minute. It is the intention to handle and transfer from one track to another the heaviest locomotives complete by means of these cranes, lifting them high enough to clear others remaining on the floor, while for handling parts and lighter loads there is an auxiliary hoist capable of lifting 1,000 pounds at a speed of 100 feet per minute. The new building will also be fitted with four swinging cranes, one of 20 feet and three of 17 feet 6 inches swing, also with two freight elevators of large capacity, each 6 by 12 feet.

The general view shows a row of large windows beneath the cranes and a row of smaller ones above them. There will be 24 large skylights in the roof. The shops will be well ventilated and every facility will be given for careful work, with the greatest comfort to workmen, this being the primary object of the improvement.

Adjoining the erecting shop and facing on Fifteenth and Spring Garden streets will be an L shape building four stories high, and with a frontage respectively of 208 and 228 feet on the two streets. That part on Fifteenth street will be 60 feet wide and that part on Spring Garden street 50 feet wide. The first floor will contain the machinery for boring and finishing cylinders, the second and third floors will be used for storing finished locomotive parts and for light sheet-iron work, such as jacketing for boilers, and the fourth floor will be used for finishing and painting cabs.

While incidentally the capacity of the works will be somewhat increased, the principal advantages sought by these improvements are sufficient space to do the work comfortably, carefully and leisurely, without the necessity of hastening shipment to avoid blocking the shops.

A Bicycle Railroad.

Coney Island is a popular watering place near New York; and all sorts of shows, spectacles and miscellaneous attractions are brought to the place for the purpose of drawing honest dimes from the pockets of visitors. The latest attraction to this place is a bicycle railroad, and the very newest form of excitement is to take a ride on the Boynton one rail railroad, two or three miles of which is in operation as a sort of pleasure show. In the bicycle railroad a single rail is traversed by vehicles having double flanged wheels and the tendency to topple over is resisted by overhead rails which act as guides for pulleys connected with the upper part of the engine and cars. The engine is a curious looking machine and answers to the man's description of his dog who said that it was part hound and all the rest dog. The boiler and cylinders appear to be locomotive and all the rest bicycle. The driving wheel is single and is about nine feet diameter. The cylinders look to be about 11 × 18 inches. The engine is reported to have attained a speed of 120 miles an hour, but we do not believe it, because the line is not long enough to get up a speed of that character and provide room for stopping. We have no doubt that the Boynton system offers high speed advantages.

The cars in use are double decked, about 45 feet long and provide sitting accommodation for 108 persons. That is, there are nine lower and nine upper compartments, each one holding six persons. Passengers enter the upper deck from a raised platform. The cars are not high enough to be top heavy, and they look practicable vehicles for ordinary roads. The plan might be used to advantage on the urban and suburban railroads where car accommodation is over-taxed most of the time. There is certainly a minimum of dead weight to the paying load. Each passenger is carried with about 300 pounds of dead weight.

When the trains are running, the cars appear to balance themselves like a bicycle and run along without leaning on the side supports. There might be a place for a railroad of this character but it does not effect the wonderful saving of power its advocates claim.

Letter Ballot Circular.

At the last Master Car Builders' Convention it was decided to send to letter ballot six new candidates for association standards. Secretary Cloud has lately issued the ballot circular which calls for votes to establish standards on journal box for 60,000-pound cars, journal box lids, loading bark and logs on cars, drawbar and safety chains for passenger equipment cars, brake beam lever, and train pipe for steam heating. The circular contains descriptions and illustrations of the appliances to be voted upon. There is no great urgency for making standards of any of the things submitted, but there is nothing against the action, and they are all likely to be added to the list. The most important question is that proposing to make standard the train pipe fittings for steam heating. The general introduction of interchangeable pipe fittings will prevent considerable inconvenience in through travel during winter.

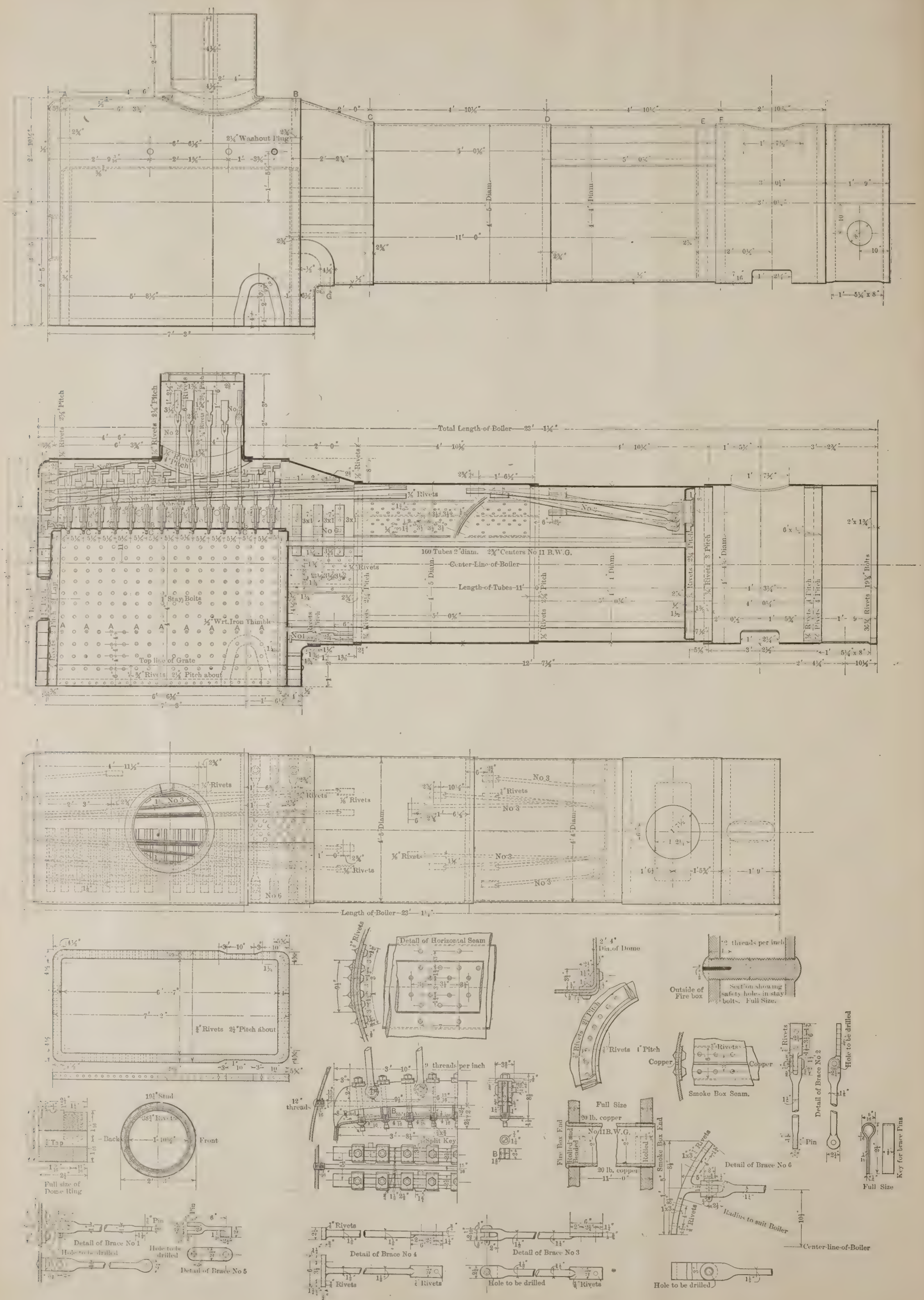
There is no question that the cause of the discontent of the New York Central trainmen which led to the strike was the introduction by the company of the mogul locomotives. This is a sentiment antagonistic to progress that has appeared regularly to oppose every advance in manufacturing methods and in improved machinery since improved methods began. We have no doubt that there was vigorous kicking against the innovation that substituted a mill for the hollowed stone for grinding corn. The introduction of the potter's wheel was likely the cause of discontent among the men who had previously made stew pans by the unaided hand. The history of manufacturing industry is the history of an unceasing conflict between the designers of improvements and the workmen who are constitutionally against change. The workmen of the United States pride themselves on their intelligence, but their opposition to improvements is often as unreasonable as that of the men in Central America who caused a "tie up" some years ago because a watch had been introduced to regulate the working hours. The men had adopted the theory that a certain donkey employed on the work brayed accurately at 4 o'clock (the quitting time) each afternoon. So long as the time-piece and the donkey agreed approximately, no difficulty was encountered; but one day the watch was half an hour slow, or the jackass brayed a half an hour ahead of time, and the men revolted in a body because the watch was decided by the foreman to be the more reliable time-piece.

Master Car and Locomotive Painters' Association.

The twenty-first annual convention of the Master Car and Locomotive Painters' Association will be held in Boston, Mass., on Wednesday, the 10th day of September, 1890, at 10 o'clock A. M., and continue in session three days for the general discussion of all subjects coming before the meeting and for the transaction of business. The headquarters of the Convention will be the American House. In a circular issued by Secretary McKeon all railroad master car painters are invited to be present at the meeting. Members who may be unable to attend the convention are requested to forward to the secretary such reports as they may have prepared on any of the questions given below or on any subject of general interest to the meeting, when such reports or papers will be read and due credit given in the official report of the proceedings.

The programme of the business to be transacted is as follows:

1. Is it a benefit or a detriment to an under coat of paint to have on eggshell gloss?
2. What is the best way to test the quality of japan before mixing into paint?
3. Should hard and soft woods be primed or treated alike to make a good and lasting job of painting?
4. What is the best one coat of paint that will hold rust back the longest?
5. Which color will show up the best on a locomotive and tank after eight or ten months of service, ivory black, lamp black, or Brunswick green?
6. What is the best and quickest method of removing old cracked and scaly paint from engine driving wheels, domes, and other rough castings?
7. Which is the most economical method of laying gold leaf, to use direct from the book or to cut into strips to suit the stripes, letters, etc.
8. Have we a chemical eradicator for iron rust?


2¼" Washout Plug
Total Length of Boiler—23′—1¼″
160 Tubes 2″ diam. 2¼″ Centers No 11 B.W.G.
Center-Line-of-Boiler
Length-of-Tubes—11′
Stay Bolts
½″ Wrt. Iron Thimble
Top line of Grate
Length of Boiler—23′—1¼″
Detail of Horizontal Seam
Full size of Dome Ring
Detail of Brace No 1
Detail of Brace No 5
Detail of Brace No 4
Detail of Brace No 3
Detail of Brace No 6
Detail of Brace No 2
Outside of Fire box
Section showing safety holes in stay bolts. Full Size.
Smoke Box Seam.
Fire Box End
Smoke Box End
Full Size
Key for brace Pins
Radius to suit Boiler
Center-line-of-Boiler

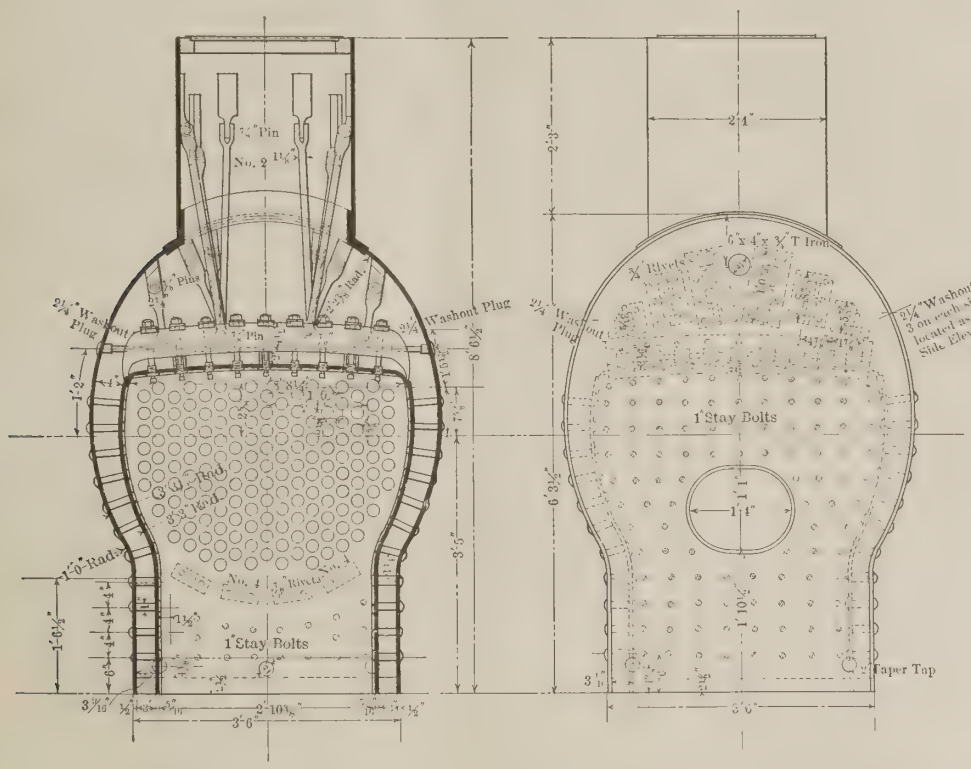
BOILER OF UNION PACIFIC SWITCHING ENGINE.

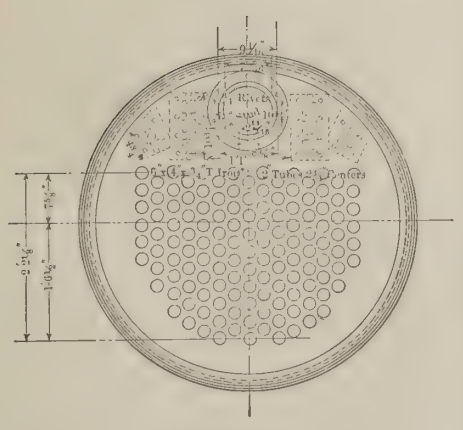
Boiler of Union Pacific Switching Engine.

The annexed engravings show several sections and the leading details of a particularly well-designed wagon-top boiler, gotten up by Mr. G. W. Cushing when he was superintendent of motive power of the road, for switching engines for the Union Pacific Railway. We do not believe in wagon-top boilers for high pressures, but we are aware that the majority of master mechanics favor them, and we are pleased to show the details of a boiler that are as well worked out as anything can be done for such a form.

The details of construction are so clearly shown in the engravings that little description is necessary. The boiler is 52 inches diameter at the smallest ring and the shell is made of steel ½ inch thick, the horizontal seams being double riveted with double welts, as shown. The dome is placed above the fire-box, is 27 inches high and 28 inches diameter and is very securely strengthened.

The fire-box is 78⅛ inches long at bottom of water leg and 34 inches wide. The side sheets are $\frac{5}{16}$ inch thick, back and crown sheets ⅜ inch thick, and the tube sheet ½ inch thick. Ample water spaces have been provided around the fire-box. The crown sheet is supported by double bars set 5⅛ inches apart. These are strongly secured to the outer shell and dome by sling stays. A very good arrangement of stays is used for strengthening and sustaining the flue sheets and boiler-head. Stay bolts one inch thick and set not more than 4¼





inches apart are used in securing the inside fire-box to the shell. Nine hollow stay bolts are used on each side of the fire box, each having a ⅜-inch hole. The steel used in the construction of these boilers had to conform to the following requirements: A test strip 24 inches long by 1½ inches wide, taken from any sheet, must have, without annealing, a tensile strength of not less than 50,000 pounds per square inch, nor more than 65,000 pounds per square inch, with an elongation of not less than 28 per cent. on a length of 4 inches. Reduction of area at point of fracture to be not less than 50 per cent. of original area.

Fitting Bolts for Locomotive Work.

In the discussion on this subject at the last Master Mechanics' Convention Mr. James Meehan said: The old method of fitting bolts to reamed holes in a great many repair shops was to have the lathe-man who does the turning fit them to the reamed hole. This proved to us to be very expensive, and we adopted a method of guages and calipers to expedite and cheapen this class of work. Our calipers are case-hardened and ground out, varying one-hundredth part of an inch. We use straight holes in engine truck frames and various other classes of work where wrought iron braces are bolted together, we finding that the straight holes where bolts were to remain permanent were in a great many cases the most substantial,

When the holes are reamed, the man who turns the bolts is furnished with calipers to turn the bolt by, which always conforms to the reamer, and which is neatly calculated to drive with a hand hammer of 4, 6, 8 or 10 pounds, as the necessity of the case demands. All rod bolts, cylinder saddle bolts, or other bolts of this nature, are made to taper one-sixteenth inch to the foot. We have a system of cast-iron gauges to suit the taper reamer. The gauge is made in the form of a bush and reamed out to the various lengths of the reamer. When the hole is reamed, the gauge is selected to correspond with the size of the hole, and left on the lathe where the bolts are turned, with instructions to give them ¼ or ⅜ draft, as the case may demand. The man fitting the bolts can see at a glance whether the bolt is perfectly in conformity with the reamed hole in the gauge, by dropping the bolt into the gauge. By this method bolts can be driven in the same manner as a straight bolt, thereby avoiding the necessity of the bolt turner calipering the hole and fitting the bolt thereto, in the ordinary way. This method has been instrumental in saving us a great deal of expense and trouble in this class of work.

Mr. Pulaski Leeds said: I would like to know how many of us there are who use straight bolts for straight holes. I have always found that there was a slight taper to them, almost universally. For a good many years I have made a practice of taking every bolt from the blacksmith's shop, roughing it out and turning it down to the size of the thread, and cutting the thread in the bolt cutter, as I have found with manufacturers generally, the fit was on top of the thread, on the burr, and after running a little while the nuts were very loose. By cutting them in a four-die bolt cutter, I found that I got a perfect thread and the nuts would always be tight. I then put these bolts away, and when they are ready for fitting we run the finishing cut over them, and fit almost always to ring gauges and invariably with a slight taper.

I have adopted that universally, for the very reason that a great many of our holes are through wrought iron and cast iron. Any reamer I ever saw yet will ream larger in cast iron after passing through wrought iron, or reversing it and passing the reamer from cast iron into wrought iron. This is especially apparent in bolting on cylinders. I think almost all of us have had to rebolt cylinders, whether they were fitted by ring gauge, snap gauge or by caliper. We drive our bolts through wrought iron first and then into the cast iron. We have a larger bearing in cast iron than in wrought iron, and can afford to stretch the sheets in driving bolts.

TAPER FIT FOR CRANK PINS.

I have a light taper on my bolts and I adopted the same thing on my crank pins. I always found with a manufacturer's fit or a home made fit, either, for that matter, that in every crank pin I ever took out, unless it was fitted on a taper, it had a bearing on the point, on the inside of the wheel where it did no good, and outside the pin would always work. Of course there are a great many theories advanced that the working strain on the rod will compress the grain of the iron in the outside of the hub, and consequently make the hole oblong and thus make it loose. But I found by advancing the taper for two inches before reaching the collar on the crank pin so as to increase the pressure to ten tons in putting in all, that pins coming out of such a hole after long service (taken out because I thought the fatigue of the metal had carried it beyond the point where it was safe), were universally tight.

I do not think it is beyond the range of possibilities to fit any number of bolts and ream any number of holes so there will be very few of them that will not go, as Brother Meehan says, with a four or an eight pound sledge. There is quite a great variation in the blow. At the same time I think they will come near enough to uniformity so that they can be turned if the gauges are properly adjusted to the reamers.

My practice has been to buy my standard reamers absolutely to the size. As they get dull I run an emery wheel over them and I have gauges to which those reamers are reduced every time; the inch reamer is reduced to a scant 64th or a 64th exact. I understand that a great many take exception to the word "scant." I have gauges that fit that reamer, and I have had very little trouble on account of loose bolts through cast iron and wrought iron, or wrought iron and cast iron, or directly through one metal in two pieces.

My rods I fit together with taper bolts, and every rod is reamed under a drill press. I find that I can size these holes so perfectly that I can carry a stock of bolts that are fitted to gauges, and with an eighth of an inch taper to the foot. I never have to touch the bolts. If I want one on any of the engines for round house repairs or new work, I can pick up a bolt and put it in and it will come so close to the same size every time, that I have no trouble in putting it in and utilizing it. You understand, gentlemen, by taper I do not mean anything more than just barely an appreciable taper. But as to driving a straight bolt into a straight hole. I never saw one fit yet. If it did it was an accident. Probably all of you have noticed, in cases of driving axles pressed on, and then from some cause taken off, that where there has been a straight fit, the tool marks were all smoothed out for two or three inches on the end, while the rest showed no signs of having filled the hole. I think this could reasonably be expected, as the wrought iron axle is not compressed to any appreciable degree, while the open grained cast iron is forced into a greater density, just the same as any metal, under a blow or great pressure will yield and set, and there being but slight elasticity to cast iron, it does not contract after being displaced on the same principle that the dent remains after the blow.

A gentleman asks me if I have an established taper for my crank pins. I will answer that in the last two inches of the fit I raise the the pressure about ten tons from what it was put in the rest of the length of the fit. That is something I do not very often give as measurements to my men, as they take their fits by the daylight under the caliper.

Index of Master Mechanics' Reports.

The Executive Committee of the Railway Master Mechanics' Association have given the Secretary directions to prepare a general index of the Annual Reports of the association, and he is engaged on the work. He expects to have the index ready some time in October. The Master Mechanics' reports contain a most valuable record of locomotive progress during the last twenty-five years and many of the annual volumes are rich mines of mechanical information. Their value has not been properly recognized for want of full indexes to indicate where full information was to be found. The reports on boilers are a library of information in themselves. It is difficult to find a subject relating to locomotive matters that has not been investigated and discussed at past conventions. The records of experience presented in the various reports ought to supply warning signals to those who are inclined to chase mechanical phantasies.

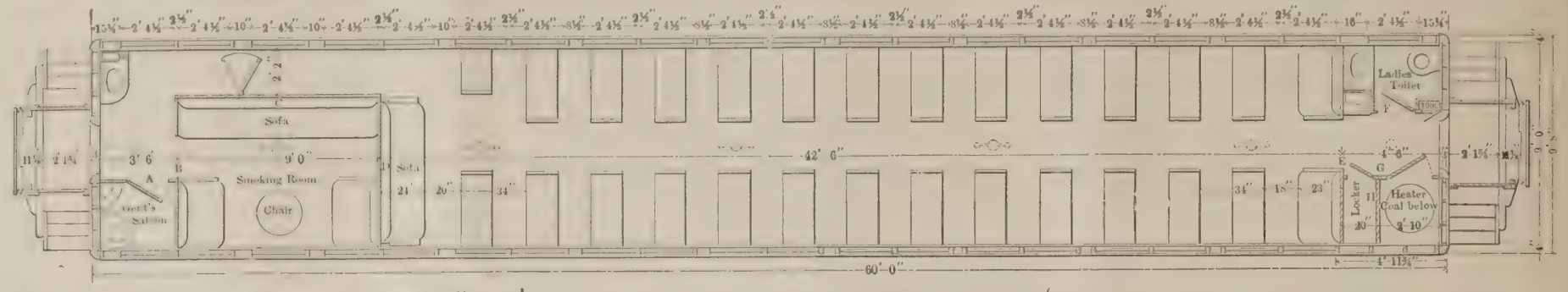
It will be seen that the railway master mechanics of America have been exceedingly liberal in giving trials to inventions that promised to be improvements on the machinery in use. Frequently the inventions proved of value, but at other times they were failures; but attempt after attempt would be made to obtain for impracticable devices a permanent place. The reports furnish a very interesting history of locomotive improvements during the time the association has been in existence, and a full index will enable students to obtain the facts without tiresome labor. The illustrations of locomotives and their parts will be of value for reference in every railroad drawing office. Making out an index of all the reports is a laborious proceeding, but it will be a great convenience to railroad men and writers on railroad subjects.

The Westinghouse Air Brake Company has used for over two years steel fittings for air brake piping to the exclusion of galvanized malleable fittings, and has found them very satisfactory. Galvanized fittings of the best manufacture have given considerable annoyance, while the steel fittings are found to be air tight, the threads full and sharp and accurately tapped, making these fittings the best in all respects for air-brake service. As is known, the company has recenty adopted the policy of not selling pipes and fittings, but it recommends to its customers, as we understand, the steel fittings. The difficulty of maintaining perfectly air-tight joints in train piping is very great and the ordinary run of malleable fittings are not only imperfect in gauge, but often so imperfect in finish as to permit serious leakage. The difference in the price of steel fittings and those of malleable iron galvanized is nominally not great, while, probably it is often more than made up by the number of malleable fittings found defective and rejected. Steel fittings are now used by many railroads, and also by contracting car builders. Various roads are also using them for locomotive work, in sizes of from ¼ to 2 inches, having found them economical in connecting up and also in maintenance.

New Baltimore & Ohio Cars.

The annexed engraving shows a floor plan of the fine passenger coaches lately put in service by the Baltimore & Ohio Railroad Company in fast trains running between New York and Washington. In sending us the blue print from which the engraving was made, Mr. E. W. Grieves, master car builder, says:

"I enclose herewith floor plan of the coaches just received from the Pullman Company for service in the line



between New York and Washington, over the B. & O., P. & R., and C. R. R., of New Jersey. This is to be a joint line, each of the three companies furnishing its quota of the equipment to form it. The cars, however, are uniform, being lettered: 'New York, Philadelphia, Baltimore, and Washington,' and the only designating marks being the initials of the road embossed on the transom glass inside. The cars are painted royal blue, and bearing on the sides the coat of arms of Maryland, Pennsylvania, or New Jersey, according to ownership, and ornamented with silver. The cars have vestibules, Janney-Miller combination platforms, the trucks being of the Pullman pattern, with M. C. B. steel axles, $4\frac{1}{4} \times 8$ journals, steel box lids, Stier dust guards, and 36-inch steel-tired wheels.

"The interior is finished in mahogany of pleasing design, and cloth window shades are used in place of the wooden blinds. Some of the cars are upholstered in seal brown plush and the rest in gold bronze, presenting a very rich appearance. The floors are carpeted, and each car has a smoking room, with ladies' and gentlemen's toilet rooms. The cars are lighted with Pintsch gas and heated by the Safety Heating and Lighting Co.'s double coil Baker heater system. These trains are without doubt the handsomest regular passenger trains in the country, each train having a porter on it and everything that can add to the comfort of the passengers has been provided."

McDuff's Crank Pin Gauge.

In sending us a blue print of the highly useful apparatus illustrated herewith, Mr. Allan McDuff, general foreman of the Burlington, Cedar Rapids & Northern Railway shops at Cedar Rapids, Ia., says:

I find by practical experience that crank pins in locomotive driving wheels frequently get twisted in the pin hub from severe strains of service, and also that the pin hub itself sometimes becomes twisted from the same cause. Shrinking very heavy tires very tight on driving wheels sometimes distorts the crank pin hub. Defects of this character are nearly always mistaken for a bent crank pin, the result being that the pin is driven out and a new crank pin put in without producing any improvement. Sometimes the old pin is put in the lathe and found true; then the machinist who judged the pin bent is blamed for careless measuring. The man is not generally to blame, The mistake made resulted from want of proper measuring tools. My experience is that the expense and delays resulting from misunderstandings about the real condition of crank pins can be avoided by the use of this simple form of crank pin testing apparatus.

The tendency of locomotives is to wear the crank pins eccentric with the original center of the pin. This causes a very dangerous defect, yet it is very difficult to identify by the ordinary methods of testing crank pins. I have found crank pins from $\frac{3}{16}$ to $\frac{1}{4}$ inch eccentric from the true center of the pin, yet they were declared by skillful machinists to be all right. The journal was smooth and truly cylindrical, as found by calipering. In ordinary practice, pins in this condition are sent out with connections nicely fitted up, and those in charge cannot understand why the shearing of rod bolts follows, and keys enough are lost to pay for new crank pins in six months. If an engine in this condition does not break a crank pin or a side rod, it is more by good luck than good management.

The crank pin gauge hereby illustrated was designed to detect defects of crank pins, and it performs the duty very successfully. The principle of the device is the making the crank pin carry and control two marking points, which describe a circle on the crank pin hub and on the end of the crank-pin, these circles supplying the means of showing whether or not the crank-pin is parallel with the axle and how it stands in relation to its original center. Referring to the engraving, Fig. 1 shows a side elevation of the device as it appears when set on a crank pin, and Fig. 2 is a transverse section of the gauge. The foundation of the device is a right angle iron plate *A*, which presses on the crank pin and carries the marking connections. The marking rod *B* is held parallel with the crank pin by suitable attachments. The tension rod *D* pushes the angle plate close to the hub of the crank pin, and *E* is a flexible strap which encircles the crank pin and holds the angle plate secure in its place. This gauge can be applied in a few minutes, and one revolution round the crank pin will produce marks which demonstrate with geometrical accuracy the condition of the pin. If the circle described on the crank-pin hub is not concentric with the pin, the pin is not at right angles with the wheel. If the pin is worn eccentric from its original center, the degree of distortion will be shown by comparing a circle drawn on the end of the pin by the testing gauge, with a circle drawn with dividers with the original center as a center.

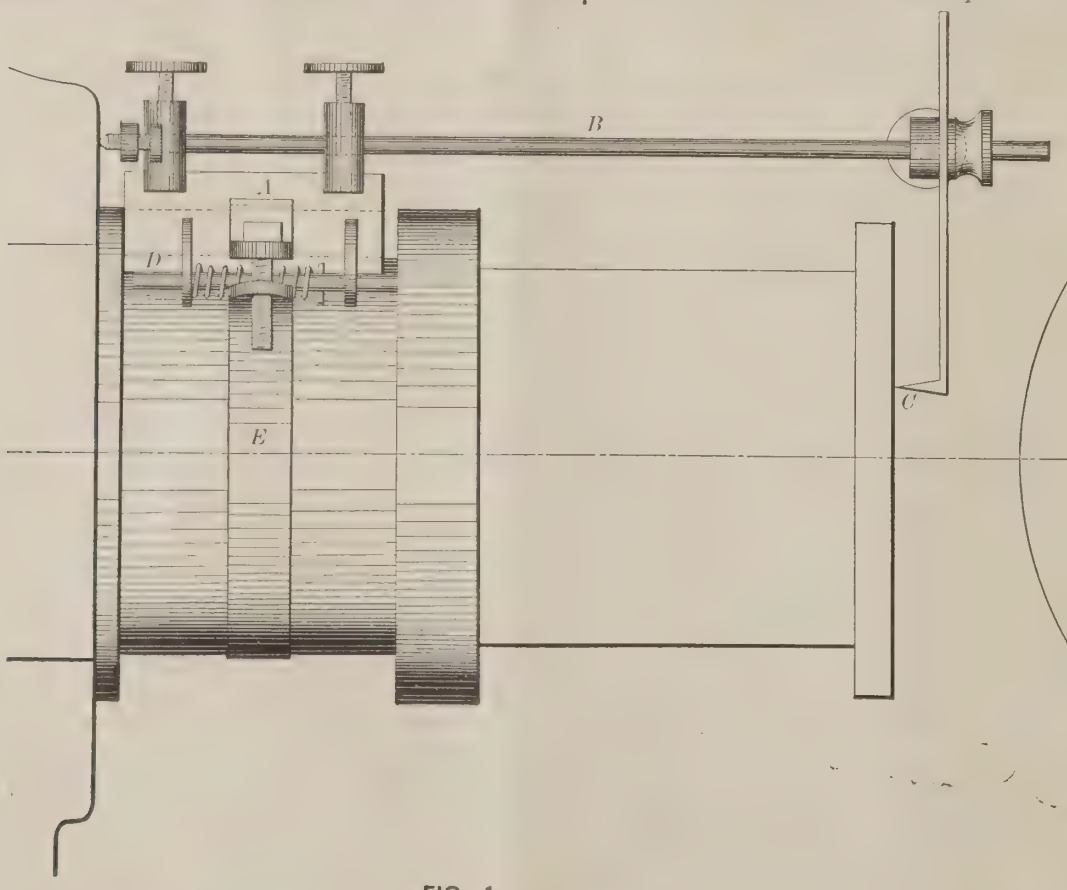


FIG. 1.

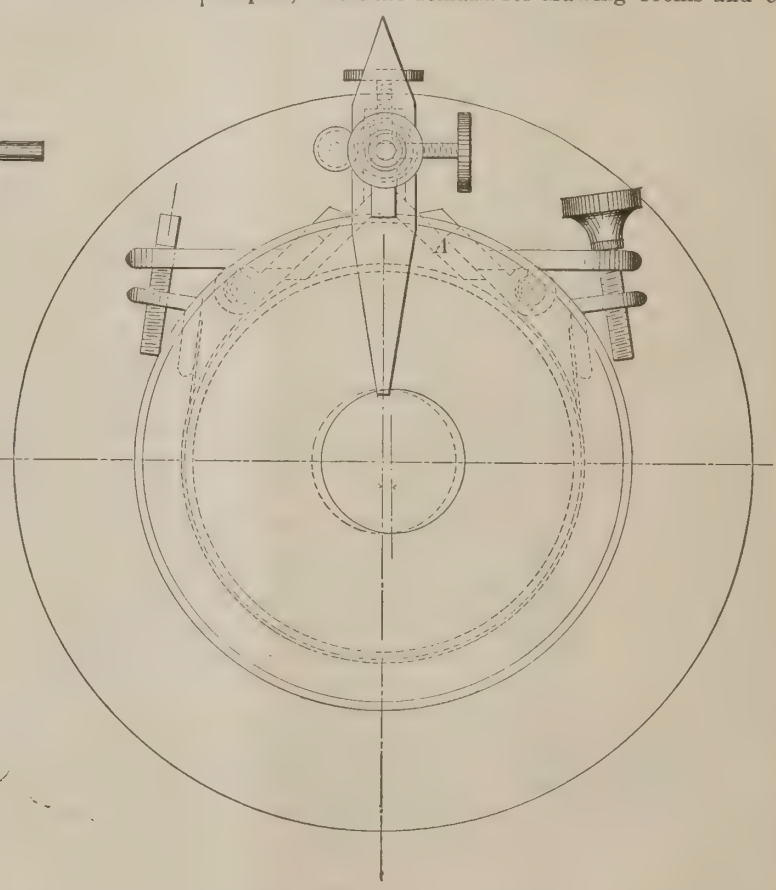


FIG. 2.

Evolution of the Smoking Room.

The evolution and final character of the smoking compartment of the sleeping car forms an interesting topic for reflection. In the early Pullman cars, in which the "state room" consisted of the section in a corner shut off from the rest of the car, with a door opening out into the aisle, one of these narrow, stuffy little compartments was usually given up to the smokers, unless needed for sleepers. Here four, and sometimes five or six, passengers would crowd in, and their cigars and pipes would soon make the air thick enough to divide with a knife. Larger accommodations were demanded and afforded by cutting off a little more space for the gentlemen's washroom at the end of the car, where chairs, camp stools and the uncomfortable seat obtained by letting down the little horizontal door under the washstand gave a chance for a larger number of tobacco maniacs to poison the air and make themselves a nuisance to those who wished to use the washroom or pass through it. The necessity of sacrificing berth space night and day to accommodate the smokers became evident to the sleeping car builders, and then came the comparatively large and airy smoking room, corresponding to the drawing room at the other end. At first this room contained berths and opened into the body of the car as well as into the washroom end, thus allowing the odor of smoke to penetrate into the interior, to the disgust of the non-smokers. Some of these cars are still in use, and the writer traveled on one the other day, in which the conductor passed to and fro through the smoking room, instead of going by the side passage, letting the smoke now and then have free circulation among all the passengers. On all cars recently built the smoking room is tightly walled off from the interior and is generally so well ventilated—sometimes taking in the lavatory apartment and so giving liberal room—that the non-smoking passengers suffer little if any inconvenience. Still the odor of tobacco is so penetrating and is so offensive to many that its production in a sleeping car will always be objectionable to some persons, no matter how carefully the compartment for the purpose be walled off, and it is a question whether the time will not soon come when every important passenger train will not have its smoking room for sleeping car passengers in an entirely separate car—perhaps occupying half of the baggage car, as on some of the limited trains, or an entire car between the sleeping cars and the day coaches. This would liberate valuable space in the sleepers, where the demand for drawing rooms and compartments is steadily increasing, and is already often too limited.—*Railway Age.*

A Worsdell design of compound locomotive is in the Edinburgh exhibition, of a class which is considered the most powerful passenger engines in the British Isles. The high-pressure cylinder is 20 inches and the low-pressure cylinder 28 inches diameter, the stroke being 24 inches. A single pair of driving wheels is used, the diameter being 7 feet $7\frac{1}{4}$ inches. The engine weighs about 49 tons in working order. An engine of the same class is said to have attained a speed of 86 miles an hour while pulling 20 passenger carriages.

Houston's Arrangement of Locomotive Smoke-Box.

The device here described, for which with the cuts we are indebted to the *Locomotive Engineer*, is the invention of Chas. Houston, an engineer on the Central Railroad of New Jersey, and is in use on engine 145, belonging to that company. Engineer Houston did not start out to prevent sparks; his idea was to improve the draught enough to admit of the use of a larger nozzle, and thus allow the engine to do more work on a given expenditure of fuel—a subject which enginemen, as a whole, do not worry over much. Houston thought that the many angles and curves that the gases had to pass through to get from the flues, under the diaphragm to the front, through the netting back, and then into the stack, must create friction, and call for a sharper blast up the stack to finally draw them off, than if they traveled in a more direct line. He studied up what little there is known of the laws of induced currents, and found that a continuous jet of steam would move a much greater volume of gas or air through a given orifice than a much larger intermittent blast.

Having secured permission to test his ideas on his own engine, a device similar to the one here shown was put upon the 145, last winter. Experiments developed faults that called for modifications until the present form of front is now used.

A steel hood was made that would cover the flue sheet at one end, and was curved and tapered just enough to fit tight up at the base of the stack; this allowed the gases to travel in the most direct route to the open stack, making no unnecessary crooks and turns.

The nozzle stand enters the hood as shown and was at first tried a third higher, but the lower nozzle does much the best.

The perforated sleeve is all the netting there is, and the openings in this are an inch by a quarter of an inch.

At *A* and *A'* there is an opening into the hood for the passage of large sparks; they of course follow the outside of the curve in making the turn. At *B*, Fig. 1, a small pipe enters the nozzle stand and turns around it, directing its jet out of the lower opening at *A'*; this is to throw out such cinders as lodge at the base of stand, and are too large to go out through the screen. At *C* and *D*, Fig. 2, is shown the arrangement of air pump exhaust and blower pipes. They enter an opening in the nozzle stand, and will stay where they are placed—this would be a good thing in any front. Fig. 2 is a front view of the device; the front above the nozzle can be taken off for examination, or to clean the nozzle or screen. It will be seen that the steam pipes are entirely outside of the hood, and their leaking will not affect the steaming qualities of the engine.

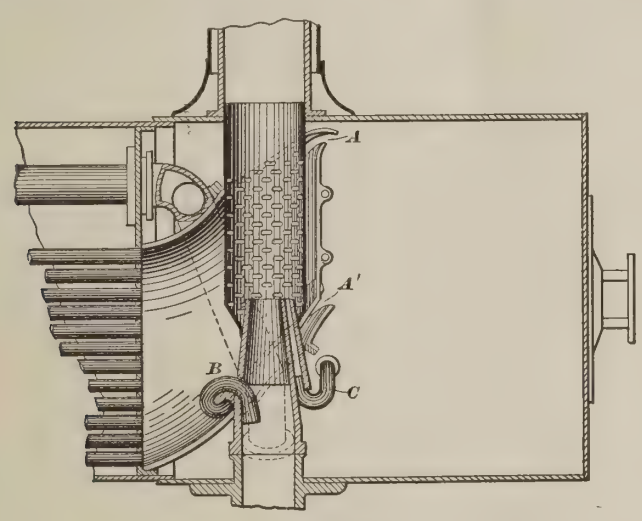


Fig. 1.

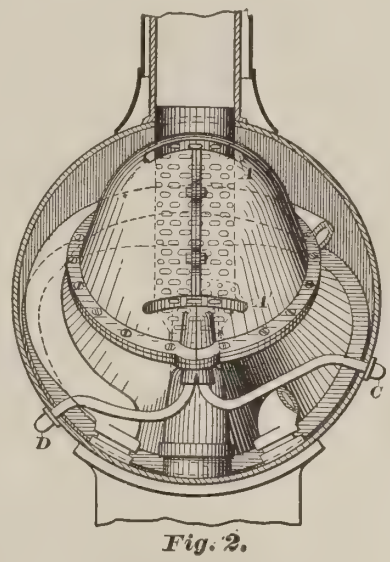


Fig. 2.

Engine 145 is an 8-wheeler, 18 × 22, with a 5½-foot wheel, and rather a small boiler; hard coal is used in a fire-box 9 feet long and 36 inches wide; she originally had a pair of 3 inches nozzles, and was changed to a single nozzle 3¾ inches in diameter; since this device has been used, the nozzle has been opened to 4¼ inches. The engine is on express runs, making 138 miles of fast time every day. One noticeable improvement is the even way the fire burns, being alike all over the box; the engine runs 101 miles without using a poker or slash bar. In May, 1889, with standard extension, this engine ran 3,744 miles, using 129 tons of coal; in the same month this year she ran 3,864 miles, using 115 tons of coal, and on one trip daily hauling a five-car train, where last year it was four cars, but it is fair to say that in the meantime the engine has been overhauled. One thing about the device, it can be applied with equal facility to a short or an extension arch—the 145 had an extension, and it was left on.

The principle of the device seems good and reasonable, and the inventor has not claimed to save all the fuel and most of the oil; his device is cheaper to make and repair than an extension diaphragm and nettings, and he runs with a larger nozzle doing more work on less fuel.

Superintendent Tait, of the Ontario & Atlantic division of the Canadian Pacific, has been arrested for manslaughter because a fatal accident happened to a train running on a time schedule which he made out and which called for faster running than the law allowed.

To Drill Square Holes.

There have been attempts at various times to devise a drill which would cut square holes with the same facility that round holes are drilled. The idea has been a favorite one with inventors, but hitherto no great amount of success has attended their efforts. During the present week the Ainley-Oakes Square Drill Syndicate, Limited, have been showing two such machines at 3 New Broad street, London. These bear each a general resemblance to a drilling machine, but the spindle instead of revolving in close-fitting bearings has a peculiar motion which causes it to cut out a square hole. In the earlier type of machine the spindle is fed down through a long rotating sleeve; this sleeve is made to follow a path of form by means of a cam at each end running in a square hole. The method of setting out the cams is thus explained: "A square hole is described equal to the hole to be drilled. From any point in one side of the square an arc of a circle is described with a radius equal to the side of the square. From the points where this arc intersects the sides of the square, other equal arcs are described completing the curve triangle. The square in which the cam is to revolve is now drawn and from each of the vertices of the curve triangle two arcs are described which complete the figure. The point of the tool, which cuts with one edge only, must be situated beneath one of the angles of the triangle." There are a separate pair of cams and a separate tool for each size of hole to be drilled. Five sets of cams are fixed on the spindle, and any set of them can be placed opposite the bearing plates. The later form of machine, which is the invention of Messrs. Tyler and Ellis, is simpler in its construction, and will drill any sized hole within the range which it covers. In the upper bearing there is a short hollow spindle which is driven by gearing. Through this spindle there passes a long hollow spindle, carried near its lower end in a ball bearing which allows considerable freedom. At the upper end of the spindle there is a roller which runs in a fixed cam path, and is held up to it by springs, which connect the spindle with the hollow driving spindle. The effect of this arrangement is that while the spindle rotates, it also rolls round in the ball bearing, and its lower end describes a geometrical figure. The drill spindle proper is within the second spindle, and carries a cutter, the cutting edge of which terminates on the centre line of the spindle. As the central spindle is raised or lowered it decreases or enlarges the size of the hole drilled, while the whole drill head is lowered to give the feed. Last Wednesday the drill was exhibited, but while we were present it was only working on gun metal, which, of course, was not sufficiently hard to afford a conclusive test of its qualities. The speed of cutting appeared to be slow, and the sides of the square were not quite straight when narrowly examined.—*Engineering.*

Badly Fastened Eccentrics.

A very sensible correspondent, writing to the *Locomotive Engineers' Journal*, wishes to know why some master mechanics run locomotives with eccentrics secured by set screws. That has long been a puzzle to us. There is no excuse for the practice with modern locomotives. When a train is delayed on account of a slipped eccentric, the proper report to the management would be: "delayed through the incompetency of the master mechanic." The fitting in of keys that will hold eccentrics securely in place is a matter of small expense, and the man who depends on set screws rather than incur the cost of keys is a very expensive officer for any railroad company to employ.

The correspondent we refer to says:

If there be any good reason why eccentrics should not be keyed on the axle I would like to know it. I have had sufficient experience with the keyed eccentric and those held by set screws only to arrive at a definite conclusion, and I find that from every point of view the keyed eccentric is preferable. It might be truthfully said that the difference in their service is a contrast rather than a comparison, and so decidedly in favor of the keyed eccentric as to permit of no argument. That the builders do not key them is due to the expense incurred by so doing. But any master mechanic who, in making out specifications, would neglect to cover that point would commit an unpardonable error, for which, sooner or latter, he will express sincere regret. It does not seem likely, but possibly there are some M. M.'s who entertain such an exalted opinion of their ability as valve motion experts that they prefer the movable eccentric, as it permits of more range to experiment with different sizes and styles of valves; and if there are any such there is no question but that their obstinacy alone prevents them from being convinced of the fact that the locomotive builders understand their business, and when they turn an engine out, the M. M., whose aim it is to make his engine pull any train with two ends to it, with little more than oxygen for fuel, will come nearer reaching the height of his lofty ambition by leaving them alone; and if he must make some alterations he'd better try something besides the valve motion to experiment on. If I ever entertained any doubts as to the advantages of one over the other, those doubts were permanently dispelled a few days ago. I happened to be a passenger on a train, the engine of which became disabled by slipping an eccentric, which became so tight on the axle that it required some time and considerable effort to move it. There was as fine an engine as I ever saw, and the very inconsistency of adjusting the eccentrics in such an insecure manner seemed ridiculous, being by far the weakest link in the long chain of mechanical perfections which the engine represented.

Unnecessary Demand for New Freight Cars.

At a recent meeting of the Car Accountants' Association, Mr. W. G. Wattson said:

THE freight car has become so great a factor in the competition for traffic that the number of available cars, instead of their performance, is the desideratum. Railroads have been so multiplied that nearly all traffic is competitive, and while the rate and time in transit are the controlling factors, neither can avail without the support of a full supply *of the most improved kind* of cars. I emphasize the words, "of the most improved kind," because the car of 20 tons capacity has not more than forced the 15-ton car from through service, when its own usefulness is threatened by the appearance of the 25-ton car. Not only this, but special cars are being built for different classes of traffic; for instance, furniture cars (the larger, the more favored by shippers), ostensibly intended especially for furniture, but which are an active factor in the competition for all bulky shipments of light weight, such as carriages, household goods, hay, baskets, empty crates, etc. Special horse and cattle cars, refrigerator cars and ventilated fruit cars are also playing well their parts as missionary agents for competitive traffic. A new road is opened and puts on a line of new cars, built after the most approved patterns, and begins to compete for business, and the older lines must have cars equally good or lose their traffic. When the crops are harvested an immense quantity of freight is at once offered for shipment, and the road which has the most cars generally secures the most tonnage. The great delay to the foreign car (the car away from home), both under load and empty, breeds a fictitious demand for more cars, and they are built, when the real practical need is more movement of the cars already built. Under these conditions the equipments of the railroads are rapidly increasing, and the situation is further aggravated by the great influx of cars belonging to private car companies and shippers of specia commodities.

We have received from Mr. J. B. Glover blue prints of a lubricator for locomotive driving and truck boxes which is in use on the Marietta & North Georgia Railroad. Mr. Glover writes: It has given remarkably good results as to economy of oil and time. I feel some assurance that it is at last a solution of the problem of a cheap and reliable mechanical oiler for the journals of locomotives and cars, and that I may succeed in effecting its adoption by the railroads of the country. You will observe the device is *made entirely of metal*, and that there are no wicks, pads or other absorbents used in its construction, but that it is entirely mechanical in its operation. The device is equally applicable to car journals, though I have not as yet given it a trial under cars. I think that you will agree with me when I say that it certainly is time that railroad men were looking about them for a more reliable and mechanical method of lubricating journals. The journal box which is at present used under cars is identically the same thing as was used fifty years ago. A device more wasteful of oil than the ordinary journal box could scarcely be devised.

President Fish, of the Illinois Central, is greatly pleased with the generous responses his proposition to the employés to purchase stock of the company is meeting. Since his proposition was made the employés have invested thousands of dollars, it is stated, in the stock, and the movement is but in its infancy. In New England fully two-thirds of the stock of the roads is held by people living on the lines or employed by the companies.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

SEPTEMBER, 1890.

Subscription.—$1.00 *a year for the United States and Canada; $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Side Rods and Distorted Crank Pins.

There was a time in the history of American railroads when the breakage of locomotive side rods was such a common form of accident that a strong sentiment developed in favor of single coupled engines, and great labor and expense were incurred in experimenting with peculiar single coupled types that promised to supply the required adhesion while dispensing with the dangerous side rods. An important merit claimed for the Webb compound locomotive by the inventor was, that the required adhesion is secured without side rods being used. Accidents from broken side rods and crank pins are still more numerous than they ought to be, but the present generation of railroad men have little conception of what the condition of things was in this respect 25 or 30 years ago. Some years ago the superintendent of motive power of a prominent railroad speaking in the Railway Master Mechanics' Convention, said: "In 1862 we broke a steel side rod about every three days. (The company had only about 100 locomotives then.) In the course of a couple of years from that we had our line laid with steel rails, and instead of breaking from six to ten steel rods a month, we did not break that many in two years. I think when proper mechanical proportions are observed in the engine, and the crank pins and all the parts are true, and you have a good track, it does not matter much about your side rods, except that, as engineers, you should try to get them as light as possible." Since these words were spoken our worst track has been made as good as the best was 30 years ago, proportions of parts have materially improved, the knowledge of railroad mechanics respecting the strength of material has been greatly increased and machinery for producing accuracy in locomotive construction has been very much developed, yet a week seldom passes that we do not hear of some serious accidents due to the breaking of the mechanism for coupling driving wheels together. In a late months' report of train accidents we find that in thirty days three persons were killed and thirteen injured by side-rod accidents, and the accidents reported probably represent but a small portion of the property destroyed from this cause.

When the subject of locomotive side rods has been under discussion in mechanical meetings, there has been noticeable a striking difference in the experience of speakers as to the difficulties encountered in running side rods without accident. On some roads, accidents from the breakage of side rods are very rare; on others such accidents are of common occurrence and the responsibility arising from this source of danger makes the life of the master mechanic a burden. Inferior track undoubtedly contributes a multiplicity of severe strains that distress the best material and finest workmanship, but the high percentage of side rod breakages and inferior condition of track do not always keep company. We suspect that certain practices followed in the repair shops exert a more powerful influence than the condition of the track in causing accidents to side rods.

If side rods are connected in such a way that they will be subjected to only what may be termed legitimate stresses, there is likely to be very little wear to the brasses and journals and no accidents from breakage. The legitimate strains are the pulls and thrusts transmitted when there is a tendency to slipping, occasional shocks due to bad track, and the momentum strains due to the sudden changing of direction of the rod at high speeds. Rods that are subjected only to these legitimate duties are connected in a perfect manner. The crank pins are so adjusted that the axis of each is maintained parallel with the axle; all the crank pin centers are an equal distance from the centers of the axles, and the axles and pins of connecting pairs are trammed the same distance apart. When an engine in this condition, and with the wheels exactly of the same size, is running along in ordinary service, the only strains on the side rods are those due to the changes in the direction of motion, and the connections will run many thousands of miles without attention. Perfection in adjustment cannot easily be secured, but an approach to it can be reached, and is daily reached, by good machinists. There is no part of a locomotive that calls for more skillful manipulation than the side rod connections. When these rods and their crank pins are properly adjusted the man running the engine will tell that the side rods require no care; when they are improperly put up, the engine will prove a constant cause of anxiety, annoyance and delay.

When a crank pin is so adjusted that its path of revolution does not coincide exactly with the path traversed by the connecting pin, there will be severe strains put upon the connections when the pins are passing over the space where the distance apart is not the same. If two connecting crank pins revolve in such a way that there is a difference in the distance between the axis of the centers at different points of the stroke, the connections must yield to permit movement or something will break. A pin set out of "square" with the axle has one part of the journal sweeping a larger circle than the other that is set true. A pin with the measuring center eccentric with the journal will lead to wrong measurement of the rod, with the result that the latter will be short at one part of the circle and long at the other. If the measuring center of the axle is not the true center, it will lead to rods of the wrong length being applied.

In the days when locomotive cranks were quartered by square and bob line the opportunities for blundering were too abundant for ordinary workmen, and many accidents to side rods and crank pins undoubtedly resulted from bad quartering. The general introduction of good quartering machines has done much to eliminate this source of danger, but ignorance, recklessness and carelessness sometimes succeed in rendering the best appliances inaccurate, and we sometimes still meet with locomotives built in shops where modern tools are in use that have badly quartered wheels. Those who control the purchase of new locomotives for railroad companies do not act in the interest of their employers when they order engines from concerns that do not have first-class machinery for doing the work. We lately examined a group of new locomotives built in a second-class contract shop that were giving great trouble with their rods, and there is every reason to believe that the wheels of all the engines were badly quartered. A good quartering machine, or even a quartering attachment applied to a wheel-lathe, will generally secure greater accuracy than the square and line, but the best of tools require care and attention. Unless the yield due to wear is provided against the work will not be done accurately.

Locomotives occasionally work unsatisfactorily on account of defects of original construction, but the greater amount of trouble results from pernicious practices that prevail in repair shops. In some shops the centers of the driving axle are moved, so that an eccentric main journal may be trued up with the least possible reduction in size. The men who indulge in this practice are not adapted by nature to operate anything more complex than a tamping pick, yet they are occasionally to be found in charge of railroad repair shops. Men with the commonest mechanical perception do not require to be told the effect on the crank pin of changing the wheel center. A more common objectionable practice, that finds numerous adherents in repair shops, is that of changing the crank pin away from its original center. It is well known that the tendency of crank pins on the many locomotives is to wear the journal to one side. Many foremen with mistaken views of economy true up the journal with the smallest possible reduction without regard to the original center. This has the same effect as changing the axle center, and puts the crank out of quarter. Mr. Allan McDuff, a particularly able and observant machine-shop foreman, whose ingenious crank pin gauge is illustrated on another page, informs us that crank pins are frequently forced out of the proper position through distortion of the hub under the severe tension put on the wheel in shrinking on heavy tires. This is quite reasonable, although it is new to us, and is worthy of attention.

It is not our purpose here to discourse on the dangers to the safe operating of locomotives that result from unskillful adjustment of side rods and wedges. If the crank pins are accurate there is little difficulty in maintaining the rods in good running order. Crank pins are frequently permitted to get out of true quartering through the difficulty experienced in demonstrating that they deviate from the correct position. When, from the engine meeting with an accident or from severe strains of service, a crank pin gets bent, the means of promptly detecting the disorder is of the greatest importance. There has hitherto been no satisfactory means of making this examination while the wheels were under the engine. To those who have wrestled unsatisfactorily with this problem and are interested in preventing accidents to side rods we commend an examination of the crank pin gauge illustrated on page 134 of this issue. Anything that will render easy the detecting of defects in crank pins is certain to be of valuable service to railroad companies, and we think the device mentioned will do what is needed.

The New York Central Strike.

Those familiar with the employés of the various railroads east of the lakes are well aware that the New York Central has been for many years noted for the loyalty of its men to the company. The company has been celebrated for the fair treatment given to every man, high and low, belonging to the service, and this has been so well known that hundreds of men working on neighboring roads have always been ready to change employers and enter the service of the New York Central. It was then a genuine surprise to the public when the announcement was made on the night of August 8 that a strike had occurred on the New York Central Railroad, and that the trains had for one night ceased to run.

For some months we have heard repeated rumors that discontent was becoming rife among the trainmen belonging to the New York Central, and on various occasions when the opportunity offered we questioned the men at different points along the line about their grievances. An old train man can generally succeed in gaining the confidence of a new man of the same calling if he goes about the business properly, and we had no difficulty in learning the cause of the growing discontentment. The men would protest that the road was not what it used to be, and that its affairs were going to the dogs, but they soon would get round to denouncing the "hogs" as the cause of all the trouble. The "hogs" is the popular name for the mogul locomotives that are now handling most of the freight trains on the main line.

The New York Central was slow in adopting heavy locomotives for freight service, but about a year ago a large lot of moguls took the place of the eight-wheeled engines previously in use, and the result was that the freight cars were moved with a reduced number of crews. We never knew of heavy engines displacing light ones without there being more or less discontent among the trainmen, but the wholesale manner in which the change of power was effected on the New York Central, made the cause for unreasoning wrath unusually conspicuous. This gave the opportunity for the anti-capital agitator, and it was readily embraced. There was an engineer on the road named Lee who had been kept out of the Brotherhood of Locomotive Engineers, and he became a shining light among the Knights of Labor. There were a good many members of this organization employed on the New York Central and Lee and a few more natural agitators began fanning the flames of discontent among them and working up grievances. The officers of the company had been in the habit of selecting men for promotion on account of proficiency, and this became a sore grievance with those who considered that seniority alone ought to count, and a better subject for the labors of committees than the hated hogs. Lee had so much agitating business to attend to that his work of running a locomotive became a secondary matter. Others were in a similar condition. Slackness in the freight business required that a reduction of the force of train men should be made, and the officers having the men in charge took the opportunity to dispense with the services of the men least useful and among them was Lee. The connection of this man and others with the Knights of Labor, and the time they devoted to affairs of the organization detracted from their efficiency and usefulness as train men, and on that account it was common sense business for the officers of the railroad company to let them go. Agitators generally rely on their dupes being the victims of the discharging guillotine, and this crowd felt particularly exasperated when they found themselves, instead of the smaller fry of their order, decapitated. They immediately howled with one voice that they were discharged because they belonged to a labor organization. They demanded reinstatement, and on that being refused they succeeded in inducing about one thousand members of the Knights of Labor to strike. The movement was so arranged that the tunnel leading to the passenger station in New York City was blocked in the evening by trains deserted by their crews, with the effect that all trains in that quarter were stopped for one night. They expected an easy victory, but the vigorous and far-seeing officers in charge of the operative departments had the passenger trains running pretty regularly next day, and the paralysis of freight traffic was short-lived.

The men had no case before the public, and the public and press with unusual emphasis and unanimity condemned the strike and all those responsible for precipitating it. All private employers of labor are tenacious of their right to employ the workmen that are most competent, and there is a disposition manifested to sustain the railroad

company in discharging the men who had ceased to be efficient. After the strikers were thoroughly beaten they began making noisy agitation for settlement by arbitration. The time for arbitration is before striking, not after the battle is lost and won. We do not think that arbitration will ever work when it is appealed to as a means of deciding what men a railroad company or a private employer of labor shall select to fill responsible positions.

Adopt Established Standards.

For several years, which includes the most useful years of its existence, the principal work done by the Master Car Builders' Association has been the adopting of standard parts for freight rolling stock. The importance of the work done has been very great, and the saving of expense in car repairs combined with the prevention of delays in freight movement that has resulted has amply repaid railroad companies for the time devoted to the Master Car Builders' Association by their representatives, yet the fruits of the labor performed are by no means so bountiful as they ought to have been. The sentiments in favor of standards as manifested in the conventions by voice and vote is all that could be desired; but the sentiment that leads to unanimous voting in favor of standards is too evanescent. In the settling of the business of establishing standards, we would like to see a little more display of earnest conviction that would influence the members throughout the whole year. The conventions are too much like some people who attend revival meetings where the prevailing religious fervor makes hosts of temporary converts, and they, entering into the spirit of the place, become wildly zealous for salvation for the hour, and then go away and indulge in their familiar iniquities as freely as if they had never heard sin denounced. The atmosphere of each recurring convention is hot with standard-forming zeal, and the prevailing sentiment exerts a sort of magnetic influence on many members who become anxious for the nonce to arrange for making every part of a car standard without a moment's delay; but it is woeful, the back sliding that most of the converts experience after their return home.

We wish to enter an earnest plea for a little more consistency among those who take a part in establishing standards. It is not complimentary to the other man to act on the principle that the establishing of standards was done for his benefit alone. Those who vote for a standard ought to understand that by implication they have expressed themselves in favor of it, and that they are therefore bound to adopt it in their own practice or rest under the imputation that they had recommended for the use of others forms they did not consider good enough for their own service. The case ought to be presented in this plain way. Voting in favor of a thing and then ignoring it in practice is not an exemplary proceeding. If a member, when called upon to vote on a standard, sees objections to the form which would prevent him from using it he ought to vote against it, as others may have similar unexpressed objections that render the thing unsuitable for adoption as a standard of the association. It is certainly a much better plan to prevent a form from becoming a standard than to vote for it and then ignore its selection. If a member votes in favor of making a part standard, when he is convinced that it is not suitable for adoption by all railroad companies owning freight cars, he is really doing an injury to the cause of uniformity and interchangeability, for he helps to place a formidable obstacle in front of the form most suitable for adoption as a standard. A reform badly needed is more thorough investigation and more earnest consideration of the merits and adaptability of forms suggested for standard, and then more earnest effort for their general adoption.

Demand for Mechanics.

It is significant of the present condition of railroad and mechanical business that within a month we have received inquiries from two superintendents of motive power as to where they can obtain some good machinists. One wanted men for the south, where good mechanics are nearly always scarce, and are particularly hard to find at present; the other wanted men for shops belonging to a road with headquarters in Pennsylvania. Good machinists are more urgently in demand at present than they have been for several years, but first-class machinists are nearly always in demand, and can generally command good pay. The tendency of machinery manufacturing establishments toward sub-division of labor increases every day, and is undoubtedly a means of greatly cheapening production; but that method of doing work produces skillful specialists in machine manipulation and few good all-round machinists. In consequence of this and other causes, the supply of first-class machinists appears to be decreasing. Men calling themselves machinists are not scarce, but men capable of doing any machine job in a first-class manner are scarcely to be obtained in some districts. The complaint that there is no encouragement for good men among artizans is still to be heard in the land, however, but we have never known a period when there was a better chance for those who have prepared themselves for top positions.

The scarcity of all-round first-class machinists is particularly hard on railroad companies, for the nature of their work prevents them from employing specialists. A mechanic who cannot do any kind of work that may turn up is not suitable for employment in a locomotive repair shop. There has been a tendency among railroad master mechanics to curtail the number of apprentices, principally on the ground that the young men after becoming skilled workmen were in the habit of leaving the shop where they learned the business. To refuse employing apprentices on this account is a very selfish and narrow-minded proceeding. It is right and proper that young men after learning their trade should become "journeymen." The man who remains in one shop all his life receives a very limited range of experience. If a railroad company trains machinists that go into the employment of rival companies, rival companies raise mechanics whom they are likely to hire, if they give the same inducements as their neighbors. The railroad companies that continue to employ apprentices are performing a wise and patriotic service to themselves and to the country. It is a great pity that the roads which follow the narrow selfish policy cannot be prevented from reaping the good harvest that comes from seed sown by others.

While speaking of the prevailing demand for good mechanics, it may not be amiss to mention that there is still great depression in the labor market of the so-called genteel occupations. In every large city of the union hundreds of applicants strive to get every position for clerk, typewriter, etc. that is open. Yet the average American mother keeps encouraging her boys to engage in some sort of nice work where he can wear a starched shirt every day. The ultra-genteel mind does not perceive that starch and starvation are very frequently close companions.

Preferring Iron to Steel for Boilers.

We have several times lately found railroad men who expressed a preference for good iron sheets for the shells of boilers, rather than the steel that is becoming almost universally used. Every man is entitled to freedom of opinion in matters of this kind, but we feel assured that the consensus of practice and enlightened opinion tend to prove that the men who are using iron for this purpose are not acting in the best interests of the railroad companies they serve. It took some men a long time to learn that steel was much preferable to iron for fire-box sheets, and their devotion to iron was in some instances an exceedingly expensive error of judgment. There is good reason for believing that obstinate preference for iron boiler shells will in the end prove more expensive to railroad companies concerned than the iron fire box did. The man who prefers iron to steel sheets is generally one whose range of experience is limited, and whose opportunity for seeing the comparative value of the metals properly tested have been insufficient.

The advocate of iron will generally tell about some iron boiler that was in constant service for 30 years, at the end of that time was broken up, and after the long period of work the sheets were found fairly free from corrosion and of high tensile strength. This is a practical argument that appears convincing, but investigation proves it to be misleading. Steel possessing the most valuable physical qualities of the fine iron sheets, rolled in the early days of locomotive history, may now be made at much lower cost than first-class iron, and in consequence of this high class iron sheets are not now rolled. It is doubtful if ever iron sheets, with the greatest care and labor that could be bestowed upon their production, were of the uniform high quality common with carefully manufactured steel sheets. Advances in methods of manufacture and in the means of making physical and analytical tests have led the engineering world to decide that steel is the material best adapted for boilers required to carry steam of high pressure.

Years ago a committee of the Railway Master Mechanics' Association reported in favor of steel for locomotive boilers, and the association endorsed the recommendation. Lately the American Boiler Manufacturers' Association have given official recognition to steel as the proper material for boilers. There is no inclination displayed by any authorities on boiler making to return to the use of iron. This being the case, it is foolish for isolated individuals to cling to a preference that is not sustained by the experts whose opinions might be asked for in case of accident. The man who builds an iron boiler and subjects it to the high pressure of steam becoming common is taking upon himself a grave responsibility.

Railroads in the United States.

We have received that valuable annual contribution to railroad literature, "Poor's Manual," for 1890. It contains information of the usual varied form respecting the condition of railroad property, and this year there is added a series of maps of the leading railroads of the country and others that present special information in graphic shape. Among the latter are the valuable maps that have been published by the *Engineering News* showing particulars of railroad construction in the various States during four years.

The track mileage of the entire country is given as 161,396.64 miles, 5,751.01 miles of an increase having been made during 1889. The Manual says:

"The general results of the operations of the railroads of the country during the past year were more encouraging than in 188 , the accompanying statements showing a healthy growth in gross earnings, with a small reduction in the average ratio of expenses to earnings. In consequence the net earnings from traffic operations show an increase of over $20,000,000, and this sum, with an increase of $4,000,00 in the miscellaneous receipts from investments, etc., of the companies was sufficient to warrant a slightly increased return upon the capital invested.

"The showing made in net earnings is particularly gratifying in view of the many causes which tended to an increased ratio of expenses. That the aggregate net earnings failed to reach the total of 1887, or that the average per mile of road was considerably lower than those of 1886 and 1887, does not mean that the railroads cannot be worked at as low a rate now as then. On the contrary, there is every evidence to show that, under reasonable conditions, the existing railroad system of the United States could be operated at an average of 60 per cent. of its gross earnings."

With all due respect to the high financial authorities that edit the Manual, we think the conditions under which railroads can be operated for 60 per cent. of the gross earnings must be decidedly different from what they have been for some years. Many railroad companies display such a reckless ambition to get the lion's share of business that they are ready to haul cars at prices below cost. When this is done the operative departments are generally blamed for using up all the income in operating expenses. A sentiment in need of cultivation is that calling for more gross receipts in payment of the business performed. Hauling freight at less than one cent per ton per mile is getting very close to the net cost, yet the average price paid was .976 of one cent. This means that more than one railroad company hauled the freight as a sort of business amusement, and depended upon the passenger business to make a return to the shareholders. The rate paid per passenger for each mile traveled was 2.17 cents, a very fair price.

The railroad rolling stock reported to be in use on all the lines in the United States at the end of the year 1889 is as follows: Locomotive engines, 31,062; passenger cars, 23,465; mail, baggage and express cars, 7,184; freight cars, 1,060,164. This shows an increase of 1,664 locomotives, 2,040 passenger cars, 857 baggage, etc., cars, and 55,048 freight cars. Altogether the showing is good and represents the work of a prosperous year.

A Month of Accidents.

More serious railroad accidents happened during the month of August than in any month that we remember. Most of the train accidents were due to the lack of proper appliances for operating crowded railroads safely or to the carelessness of the men on whose attention to duty the safety of railway travel depends. A series of small accidents culminated in a terrible disaster on the Old Colony railroad, near Quincy, Mass., where through the carelessness of trackmen in leaving a lifting jack on the track a passenger train was derailed, with the result that 20 people were killed and many wounded. A grossly and criminally careless section foreman was entirely to blame for this terrible sacrifice of human life. It is the custom of juries to exonerate from blame on some ground or another every railroad man who is charged with crime when his neglect of duty results in loss of life, and the practice is taking away from men performing responsible duties their sense of responsibility. Hundreds of people have been killed by accidents due to murderous carelessness on the part of railroad employés, yet we do not remember of any one having been properly punished for their crimes of omission and commission.

Another accident due to carelessness happened at East Haven on the New York, New Haven & Hartford, where an express train ran into a freight train that was standing on the main track unprotected. Nobody was killed, but the man responsible for the collision did his best to make a record of slaughter.

An accident with many terrible features happened on the Southern Pacific on Aug. 22. A freight train was stopped on a steep grade and the engine was uncoupled for the purpose of taking on more cars, the air brakes being depended upon to hold the train, applying the hand brakes having been neglected. The air leaked out by degrees, and then the brakes relaxed their hold and the cars ran down the grade at a frightful speed, ending by smashing into another train that was pulling out of a siding. The result was four trainmen killed, besides the smashing of a great many cars to fragments and the demolishing of a station house. This is only one of many accidents caused on mountain grades by depending on the air brakes to hold the train when the engine was detached.

An accident with still more dramatic surroundings happened at Augusta, Mich., on Aug. 15. By the neglect of a man responsible for closing a switch, an express train ran into the side of a freight train standing in a siding, killing the engineer and fireman of the passenger train and destroying a great deal of property. Among the freight cars smashed was one containing cartridges of dynamite. These agents of destruction were scattered around, but happily none of them exploded.

In another column a correspondent who is engaged in the designing of locomotives, and is acknowledged to be a master of his business, takes up the report presented to the Master Mechanics' Association on "placing the fire-boxes above the frames," and makes out a good case for a general increase of this practice, which provides an easy means of materially increasing the grate area. We commend to the attention of the committee still having the investigation of this subject in hand, the advantage of following the line of inquiry suggested by our correspondent. If it is shown that many locomotives require to burn more than 150 pounds of coal per hour per square foot of grate area to supply the steam called for by the work to be done, it is *prima facie* evidence that an increase of grate area will lead to saving of fuel. There is an undefined impression that many of our locomotives are required to burn more fuel than the "physical conditions" make economical; but there are no accurate facts collected in a form that enables people to judge fairly how the case stands. What the committee want to do is to show how much fuel is burned per hour to the foot of grate area of ordinary locomotives. If they present full information on this point it will be easy for locomotive designers to decide whether or not a material increase of grate area is necessary.

In another page will be found an interesting letter on American Locomotives in New South Wales, from Mr. Thomas Midleton, who was for years locomotive superintendent of the New South Wales Railway. The letter will give our readers a fair idea of the popularity of the American type of locomotive when brought in competition with the British locomotive, even in places where the officials do all in their power to discredit the American machine. The letter is merely a new chapter giving particulars of obstacles thrown in the way of American locomotives, and the final triumph of the engine over them all. Mr. Midleton has been made a martyr by the representatives of the party in power in New South Wales for his devotion to sound principles in railroad machinery, no matter where the type may have originally come from.

There appears to be a "battle of the brakes" always raging somewhere in the countries out of the American continent having railroads. A skirmish lately took place in England owing to a bad failure of a vacuum brake resulting in a serious fatal accident. The Australian colonies are now in fighting mood over what brake shall be adopted for freight rolling stock. The *Railway and Tramway Review*, an influential railway journal of New South Wales, comes out strongly in favor of the Westinghouse on the ground that it is the most efficient brake in use, but it is by no means certain that such a reason will be held as good for making the brake the standard of the Australian colonies.

The Stockton Hotel at Cape May, N. J., which the Master Car Builders' and Master Mechanics' Associations have been invited to make their headquarters for next convention, is a building very well adapted for holding large gatherings. It is situated about five hundred feet from the beach, and the greater part of the rooms have an ocean view. The hotel is built in T shape, and has five or six more rooms than the Hygeia at Old Point Comfort. The proprietor is willing to give the members of the associations the first choice of rooms, and he seems ready to do anything reasonable to promote the comfort of those who will attend the convention.

Personal.

The numerous friends of Mr. James H. Setchel will be sorry to learn that his wife died last month after a long, lingering illness.

By mistake we omitted last month the name of Mr. Charles Grahame, Delaware, Lackawanna & Western, from our list of members who attended the Master Mechanics' Convention.

Mr. E. T. Silvius, who recently resigned the position of master mechanic of the Jacksonville, Tampa & Key West system, has been appointed master mechanic of the Jacksonville, St. Augustine & Halifax River road, with headquarters at Jacksonville, Fla.

Mr. A. W. Gibbs has left the position of master mechanic of the Richmond & Danville to become superintendent of motive power of the Georgia Central. Mr. Gibbs is one of the brightest young master mechanics in our railroad service, and it is to be hoped that his new employers will give him the encouragement and support that he deserves.

Mr. Henry J. Davison, a director of the King's County Elevated Railroad and a very influential business man, died at New York on July 22. Mr. Davison began business in New York as a mechanical engineer, and he had charge of some very important engineering enterprises. He afterwards entered largely into the construction of gas works, and became an expert on matters relating to illuminating gas.

Mr. T. L. Chapman has resigned the position of Superintendent of motive power of the Georgia Central, and is open for another engagement. Mr. Chapman is a highly capable man with ripe experience in the business of superintendent of motive power. He received an excellent practical training on the Pennsylvania Railroad, and there is no duty in the mechanical department of a railroad which he cannot perform and do it well.

The appointment of Mr. A. H. Watts as superintendent motive power of the Mackinaw line, known as the Cincinnati, Jackson & Mackinaw, is noted with pleasure. He will be welcomed to the ranks again by his mechanical friends, after a brief interim spent in the field as a supply man. Mr. Watts has spent most of his years on the O. & M., Old Kentucky Central and Texas roads. He throws his whole heart in his work, and results that follow are almost sure to be satisfactory.

Capt. I. Y. Sage, who recently resigned as general superintendent of the Georgia Pacific division of the Richmond & Danville, was presented on leaving with an elegant gold watch and chain by the officers and employés of the road. Captain Sage had been general superintendent since 1884, and continued in the position when the Richmond & Danville secured control of the line. He was previously superintendent of the Atlanta & Charlotte division of the Richmond & Danville, and has also been engineer of a number of Eastern and Southern roads.

Mr. William H. Laurence, well known to our readers as a representative of The A. French Spring Company, died at Pittsburgh Aug. 6. His integrity, industry and geniality placed him high in the confidence of the firm, and the same good qualities made him a favorite in social circles. His father, who was estimated as one of the most noted engineers in the country, laid out the Texas Pacific Railroad, and during the 70s, while engaged in that work, two weeks in advance of his surveying corps, died from the effects of drinking alkali water.

We wish to congratulate Mr. Henry Schlacks, superintendent of motive power of the Illinois Central, on the promotion of Mr. W. H. V. Rosing to the position of master mechanic. Mr. Rosing has been chief draughtsman of the Illinois Central for several years, and a very competent man he has been. Chief draughtsmen are among the most useful men in the mechanical department, and their efficiency generally binds them down to unlimited years of office drudgery. It takes a self-denying master mechanic to promote his draughtsman.

Mr. George W. Tilton, superintendent of motive power of the Chicago & Northwestern, met with a very serious accident last month. He was riding from the shops to the city in a way car attached to an engine, when a very sudden stop was made and Mr. Tilton was thrown down, striking his head against a box, sustaining dangerous injuries.

Since writing the foregoing paragraph we have learned that the injuries proved fatal, and that Mr. Tilton died a few days afterwards. Mr. Tilton rose on the Chicago & Northwestern from the position of a working machinist, to gang boss, shop foreman, master mechanic, and superintendent of motive power. He was an excellent machinist.

We are pleased to welcome back into the mechanical department Mr. E. M. Herr who has resigned the position of superintendent of the Galesburg division of the Chicago, Burlington & Quincy, to become assistant general master mechanic of the Chicago, Milwaukee & St. Paul at West Milwaukee. We have a great deal of admiration for Mr. Herr. He was once a telegraph operator at a small railroad station and concluded that he was not in the right position for securing success in life. So he left and went to an engineering school where he graduated. He did not consider himself a full-fledged mechanical engineer yet, so he donned overalls and went to work in the shops at West Milwaukee to acquire some more familiarity with tools and machinist work. From there he went to the tests department of the Chicago, Burlington & Quincy, rising through different grades to the position of division superintendent. He is an expert on electrical matters.

In the early days of its history the Erie Railway attracted to its employ some of the brightest mechanics of the time, who became locomotive engineers and then went all over this continent filling high positions of trust with honor and ability. The death in Oregon lately of Mr. Joseph Brandt, superintendent of the Southern Pacific lines in Oregon, closes the career of one of our pioneer engineers. He was born in Lancaster, Pa., and began railroad work in 1842. From 1846 to 1849 he was an engineer on the Erie Railroad, running between Port Jervis and Susquehanna. From 1849 to 1853 he was master mechanic of the Erie Railroad Company's machine shops at Susquehanna. Later he filled appointments as assistant superintendent of the New Jersey Locomotive and Machine Works in Paterson, and as general superintendent of the Cincinnati & Chicago Air Line Railroad. He went to the Pacific Coast in 1872 as master mechanic of the road in whose service he died. He was a brother of the late Jacob Brandt, who was long prominent as an engineer and master mechanic on the Erie road, and of A. Brandt, now master mechanic of the Southern Pacific road.

Difficulty of Classifying Steel.

When comparatively large quantities of carbon are combined with wrought iron, a considerable increase in the rigidity and brittleness of the metal is the result, and such highly carbureted metal will harden or temper if plunged when red hot into cold water, a property of great value for many purposes; but which property would nevertheless render nineteen-twentieths of all the steel used in the world wholly unfit for the purpose for which it is so advantageously employed. All attempts to define what is steel and what is iron by the temper or hardening test must fail, because the hardening depends on so many conditions. Steel which will not harden if plunged at a certain temperature into water of the mean heat of the atmosphere, will harden in an acid liquor icy cold, and steel which will not harden under these conditions may be hardened in mercury. Much also depends on the temperature of the steel before immersion; and when all these facts are considered, how are we to ascertain how much, or how little, the hardening process has actually taken place? In fact it is all a question of degree, and no definite or bounding line exists whereby we can determine what is steel and what is not steel by the hardening test. If we find this great difficulty in defining what is cast steel, how much more difficult shall we not find the task of defining what is crucible steel? In Huntsman's time and long after it crucible steel was made, of most excellent quality, by the fusion of blister steel produced from high-class Swedish iron bars; but when we find in our own time that thousands of tons of Bessemer steel rail ends are re-melted in crucibles, it is interesting to know what to call the resulting ingot. Is it veritable crucible steel? Or is it Bessemer steel in disguise?

To Improve the Steam Engine.

In his paper, read before the French Academy of Science, M. Ch. Tellier claims to be able to produce motive power for .44 pounds of coal per horse power hour. This result is obtained by using a combustible gas, employing the heat generated by its explosion to generate steam, and the use of the vapor of ammonia. When the gas has operated on the piston it escapes at a temperature of about 400 degrees into a generator where steam is produced, which is used to act upon the opposite side of the piston from the gases. There are two advantages claimed for this—the high temperature due to consumption of the gas prevents cylinder condensation and the steam assists in lubrication. The completed machine for which this claim is made will consist of two cylinders, one making its forward stroke under the action of the explosive gases, and its return stroke by the action of steam; the other is operated entirely by vapor of ammonia. Under these conditions, says M. Tellier, there can be no doubt, theoretically or practically, that .44 pounds of coal per horse power hour is economy which can be secured.

The first apparent objection to the scheme for using the combination of gas and steam is the complexity of the operations which is likely to involve the use of expensive mechanism, whose cost would outweigh any saving in fuel. There is little prospect of gain from the use of vapor ammonia instead of steam. Volatile compounds as substitutes for steam have been extensively experimented with in this country, and they have always failed. Many people remember with a sense of financial void the efforts of the Triple Thermic Motor Company to make the fortunes of many church people in New England and elsewhere by using a carbon compound as a substitute for the vapor of water.

We recently heard particulars from a master mechanic of a curious case of difficulty that he once experienced with a locomotive side rod. The engine came out of the shop after a general repair and one of the side rods kept running hot from the start. The brasses were carefully examined and there appeared to be nothing wrong. The pins seemed to be perfectly true and the bearings were ample to ensure cool running. The engineer who was running the engine insisted that the brasses were too soft, but he could not explain why one side should run cool while the other was always boiling hot, and although he strongly urged the putting in of new brasses his request was denied, and the investigation into the cause of the trouble continued. When the case was nearly given up as an unfathomable mystery, a round-house foreman discovered that one of the driving wheels was $\frac{3}{16}$ inch larger than the other three. The machinist in charge of the driving wheel lathe had blundered to that extent and it took a protracted search to find out what was wrong.

On a certain Eastern road hot boxes developed on leading trucks of three new engines fresh from the works of a leading locomotive builder. A run of 30 miles warmed them dangerously. The cause was found to be, trucks on all three, three-eighths of an inch out of square. What excuse is there for this rule of thumb way of treating a matter of such great importance? Is it any wonder that our engines jump the track and that wheels run to the flange and ruin themselves? The day for this sort of carelessness ought to have gone by.

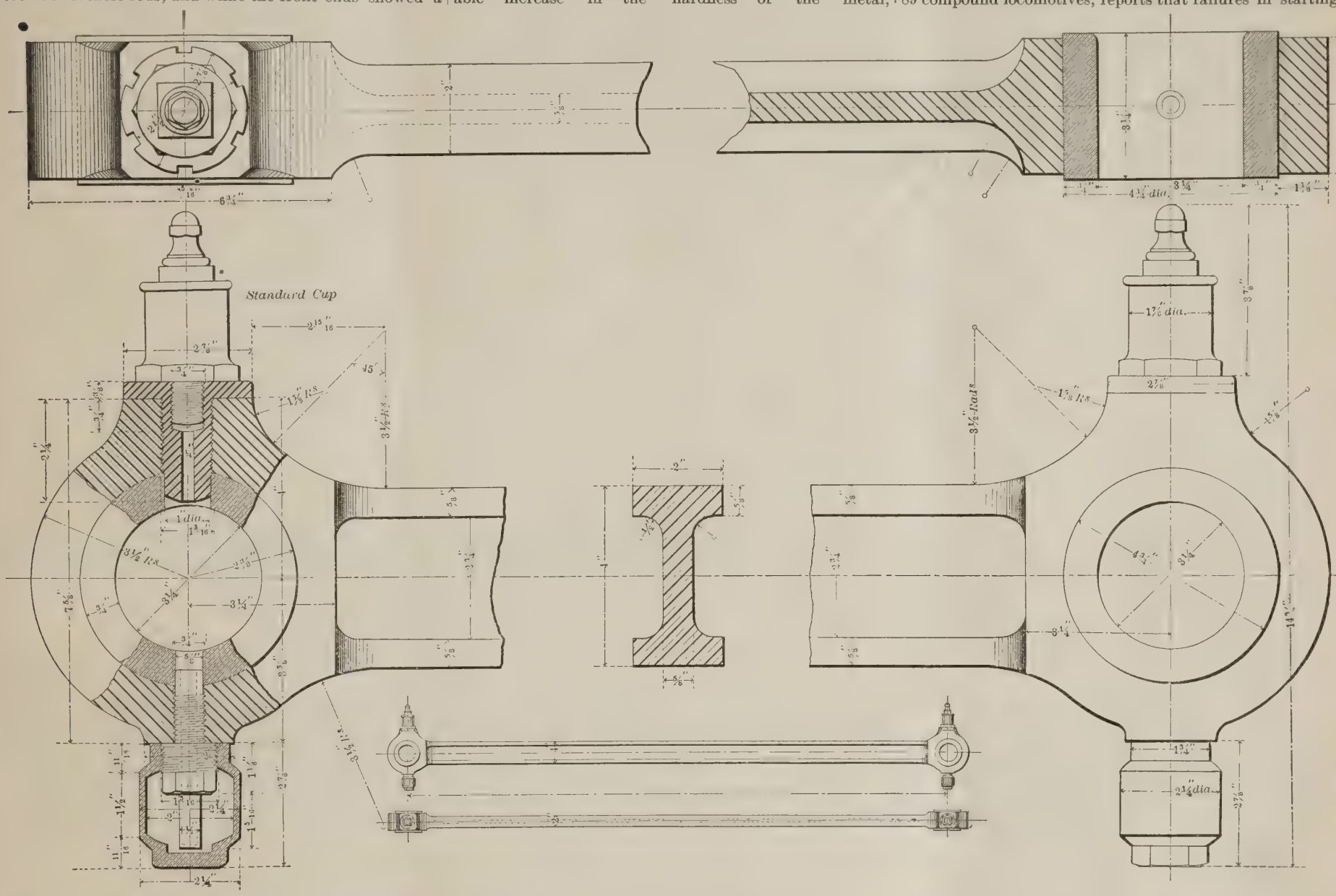
Solid End Side Rod.

In the annexed engraving we illustrate a very well designed form of solid end side rod, which is the standard in use on the Newport News & Mississippi Valley Railroad. Mr. J. W. Luttrell, superintendent of motive power of the road, in sending us a blue print of the rod, says :

Engine No. 526, doing service on passenger runs between Paducah and Memphis, 166 miles, was equipped with this side rod May 1, 1887, and between that date and May, 6, 1890, when she was taken into shop for general repairs, made 156,509 miles.

Engine was not taken into shop because her rods were considered bad, but for other repairs, and while in shop we took down these rods, and while the front ends showed a fraction more wear than the back ends, a careful calipering showed an average larger diameter of bushings of $\frac{1}{8}$ inch than when first applied.

This engine is a 16 × 24-inch cylinder Baldwin engine, and pulls four cars, making the run of 166 miles, with thirty-one stops, in an average schedule of five and one-half hours. The track is dirt-ballasted, which you know is very trying on rods in extreme wet weather.



An interesting experiment is sometimes tried with dry high-pressure steam issuing at a jet, which is rather astonishing. If a common match head is held in the invisible portion of the steam jet close to the nozzle, it at once lights, and the fact seems convincing as to complete dryness, as the faintest moisture would prevent ignition even at the highest temperature. This experiment proves dryness of the steam at the point of contact, but if throttling exists behind the jet, the steam supplied by the boiler may be in itself wet and dried by wire drawing.

The contractor of the Pike's Peak Railroad has lately given to a reporter some details of the difficulties encountered in building the railroad up the sides of the great mountain. The building of this road has been difficult, as only the acclimated can exist at an altitude of 14,000 feet, and the work of an ordinary grader is impossible until the laborer has spent at least two months expanding his lungs so as to render them accustomed to the rarefied air. Every foot of the roadway has to be graded with the aid of burros, or small donkeys, as horses and carts were unavailable on the rugged and irregular lines of the snow-capped peak. Hundreds of feet above the timber line, immersed in fleecy clouds that enveloped the laborers in rain, snow and sleet, the work was continued last winter. Cabins were constructed by scooping and blasting out holes in the face of the mountain passes. In spite of every attention to the wants of the employés, the latter grew weary of this proximity to heaven and struck at frequent intervals. The road will be finished late this season.

Changing Iron to Steel.

When pig iron is purified, and is wholly decarbonized by puddling or by any other process, a comparatively soft wrought iron is obtained, known in commerce as wrought iron. Such wrought iron loses much of its original character and acquires several new and most valuable properties when alloyed or combined with carbon. It matters not whether such addition of carbon is acquired in the process of cementation with charcoal, or by the direct addition of carbon in the form of a carbide of iron to wrought iron in a molten state; in either case the immediate and tangible effects produced by this combination of carbon with pure iron is a considerable increase in the hardness of the metal, its elasticity is greatly augmented, it becomes more sonorous, and capable of producing the sweetest musical notes. This alloy of carbon and iron when subjected to severe strains does not take a permanent set so easily as wrought iron; it also resists bending, torsion, and compression to a much greater degree, while its power to resist abrasion and general wear and tear by friction is very much greater, and what is of still more importance, its tensile strength and cohesion is immensely increased, even by the addition of very small doses of carbon; indeed, so small a quantity as one-half of one per cent. of carbon added to soft wrought iron increases the tensile strength of the resulting alloy to the extent of some eight to ten tons per square inch.

The reconstruction of the railroad system in Peru under the bondholders' contract is being prosecuted with vigor. A Lima correspondent says : "Machine shops with the necessary wood and iron working machinery are being overhauled and refitted for repair work. New boilers, tubing, fire boxes, wheels and all working parts which need replacing, or are too far gone for repairs, have already been ordered. The engine and cars in present use are mostly of American make, and consequently a considerable part of the repairs will come from America. The demand for railroad, mining and agricultural supplies will be constantly on the increase, and as all of it has to be imported, not a rail, nor a fishplate, tube nor spike being made in Peru, England and America will have an opportunity to compete. If the American manufacturers, agents and merchants, generally, wish to secure part of this business they must hustle around and get it. All material needed for the repair and extension of the railroads and the various internal improvements required under the contract are to be admitted free of duty, and as there are no export duties in the United States, the competition between England and America will be on an equal footing. For the railroads alone about $25,000,000 of supplies will be necessary, which will constitute a trade worth competing for. The New York agents are W. R. Grace & Co."

Mr. Stamoke, of Berlin, read a paper relating to compound locomotives in Germany in January last at a meeting of the Verein Deutscher Maschinen-Ingenieure, in which he gave the results obtained with compound engines by the various state railway boards. On Dec. 1, 1889, there were running 118 compound locomotives, and 87 were on order. Of the 205, 16 were express, 35 passenger, 139 freight and 15 tank engines. The Bromberg State Railway Board, employing 74 of these locomotives, reports that the coal consumption averages 12 per cent. less than the ordinary engine. The cost of the compound is about $350 more than of the standard engine, but the cost of repairs is no heavier. The board strongly recommends the adoption of compound freight engines. The Hanover board, with 89 compound locomotives, reports that failures in starting are not more numerous with compound than with ordinary locomotives. The steam supply is also ample, and the tractive power is greater than that of the standard. The premium for economy of coal consumed earned by the drivers of the compound is always higher than that earned by the drivers of ordinary locomotives, although a deduction of five per cent. is made against the compound. The amount of sparks thrown out of the chimney is less than with the standard locomotive. The Hanover-Cassel traffic office recommends that in future only compound engines should be ordered. The Frankfort-on-Main board reports a fuel saving of 17 per cent. in the Nordhausen district, and 18 per cent. in the Frankfort. The compound runs steadily at the greatest speed allowed. The Magdeburg board reports that engines engaged in a variety of work show only three to six per cent. economy of fuel. The compound freight engines, drawing heavy loads long distances, show from 15 to 20 per cent. economy.

The late William Stroudley, long locomotive superintendent of the London, Brighton & South Coast Railway, took a great interest in the details of boiler making. He followed a variety of whimsical practices in the construction of locomotive boilers intended for high steam pressure. The plates to be used first underwent a most searching superficial examination. They were, if found faultless, planed at the edges and heated to about 900 degrees, at which temperature they were bent to the required form. The plates were then drawn into the boiler shape by strong hoops, and while in the proper position the seam rivet holes were drilled through butt straps and plates. The holes were then slightly countersunk, after which the plates were taken apart, thoroughly cleaned and all the burrs polished off. After this operation was performed to the satisfaction of rigid inspectors, the plates were bolted together and carefully riveted by hand. Care was taken to keep the head of the point hotter than the point, so that the hole should be well filled in driving. A good boiler was produced in this way, but it was no better than boilers carefully made by hydraulic machinery at half the cost.

The Importance of Valve Setting.

In relation to the invention illustrated in the annexed engravings, Mr. W. C. Hayes, Minneapolis, Minn., writes us:

"Herewith please find inclosed blue print of what perhaps is the most important device now claiming the attention of mechanics. Patents have been applied for through the proper officers, and are, I understand, granted, but as yet have not been given to the public. Hence I thought it might be interesting to the readers of your valuable journal, and so have launched it. All master mechanics will admit that an engine with a lame valve gear is a very expensive piece of machinery in a great many different ways. An engine may be of good design in all its details and be provided with the latest improved balance valves, and, in fact, all the modern improvements that go to make up a first-class working engine, yet the engine will not perform good work. She will not pull cars enough; time can not be made; too much coal is consumed. The engineer is pulled over the coals, but that don't help the engine.

The engineer reports valves squared again. The engine works a little better, but is not quite right yet. Engine is run a few trips more, and again valves are reported to be squared. Valve setter runs them over again, and helps the engine a little more. Valve setter keeps at it and finally gets them to work and sound pretty good. Now, then, the question is, how much does all this work cost a railway company with from one to three or five hundred engines, to say nothing of the extra expense of fuel for such engines? I have noticed a great improvement in the valve motion on this road (Minneapolis & St. Louis Railway) within the past year, which led me to inquire into the system of valve-setting here.

After a conversation with Mr. Williams, our valve setter, I am convinced that the improvement has come to stay. In the first place, in the repair shop the rocker and lifting shaft are put up with a standard tram from the center of the main pedestal, which puts the valve gearing in good shape to work on. Mr. Williams claims that the greatest obstacle to contend with in valve setting is lost motion. He has fully proven his claim by the use of this most important device for accurately adjusting and holding in position the lost motion of valve gearing while the valves are being set. The device is plainly shown, and will be readily understood by a careful study of accompanying drawing. Fig. 1 shows side elevation, and Fig. 3 plan of device as it is attached to the engine. It is fastened stationary to the gland stud and clamped tight to the valve rod by the clamp *G*. The method of using it is to throw the lever *C* in the opposite direction from which the valve rod is moving when the crank is approaching the center. With this strain on the valve rod it causes the valve gearing to move under the same conditions it does when under steam pressure and steam holding valve to seat. It is plain to see that this is the very best condition an engine can be put in while the valves are being set; $\frac{1}{8}$ of an inch of lost motion can be as easily managed as $\frac{1}{32}$ of an inch.

This device does on the outside partly what the indicator shows from the inside, and is fully as important. It is the invention of Mr. Fred. W. Williams, chief draughtsman for the company.

Rev. Dr. T. DeWitt Talmage is as much at home in a sleeping car or a hotel as he is when in his own private study or sleeping room in Brooklyn. He never worries over trifles, often writes his sermons and lectures while traveling on steamboats or trains, and never bothers himself over missing connections. Yet he does not always have the good fortune to catch a train that he had at Toledo a year or two ago. At that time Dr. Talmage found, just before reaching Toledo on the Wabash train, that the only train over the Toledo, Ann Arbor & North Michigan Railroad would leave half an hour before his arrival. He was booked for a lecture at Ann Arbor that night, and the outgoing train was his last chance. With the characteristic modesty for which T. DeWitt Talmage has always been noted, he telegraphed Gen. J. M. Ashley, President of the Toledo, Ann Arbor & North Michigan road, asking that the train be held half an hour, and signing the telegram "Talmage." The train was waiting when the reverend doctor arrived at the depot, and he reached Ann Arbor in time for the lecture. Unless he sees this he will not know—for the angry Ann Arbor officials were too indignant to tell him—that the name "Talmage" that held the waiting train at the depot for half an hour was not the lecturer and preacher, but his brother the Wabash railroad magnate. The Ann Arbor officials had detained the train, expecting the railroad man, at a time when all the orators in America could not have kept it waiting at the depot half an hour.

The foreman of a large railroad repair shop writing to us on locomotive matters mentions a curious circumstance in regard to wear of crank pins. There are many eight-wheel and ten-wheel engines used on the road where the writer is employed for hauling freight trains. The locomotives perform practically the same service, only that the ten wheelers pull the heavier trains. When engines come into the shop for repairs, it is generally found that the eight-wheel engines wear their pins on the parts where the greatest leverage is exerted, the smallest vertical diameter being found when the crank is on the centers. With the ten-wheel engines, on the other hand, the smallest diameter is generally about 30 degrees away from the point where it is found on the eight-wheel engines. Can any of our readers explain the cause of this?

Publishers of books on railroad subjects say that there is less demand among New England railroad men for literature relating to their business than there is among the railroad employés of any other part of the country. In the West and South one seldom meets with a young engineman who is not familiar with the literature of his business, but in New England the reading men are conspicuously scarce. We lately conversed with the traveling engineer of a prominent New England railroad who had never heard of Phelan's Air Brake Practice. The man's ignorance of air brake matters was phenomenal, considering the position he held.

The *Northwestern Railroader* publishes a letter which was addressed to a railroad superintendent in St. Paul by a divinity graduate, asking for a position as brakeman. As the applicant wished to make a change with a view of improving his condition in life we may infer that the preaching industry is rather depressed in Minnesota at the present time.

The Educational Effect of Law.

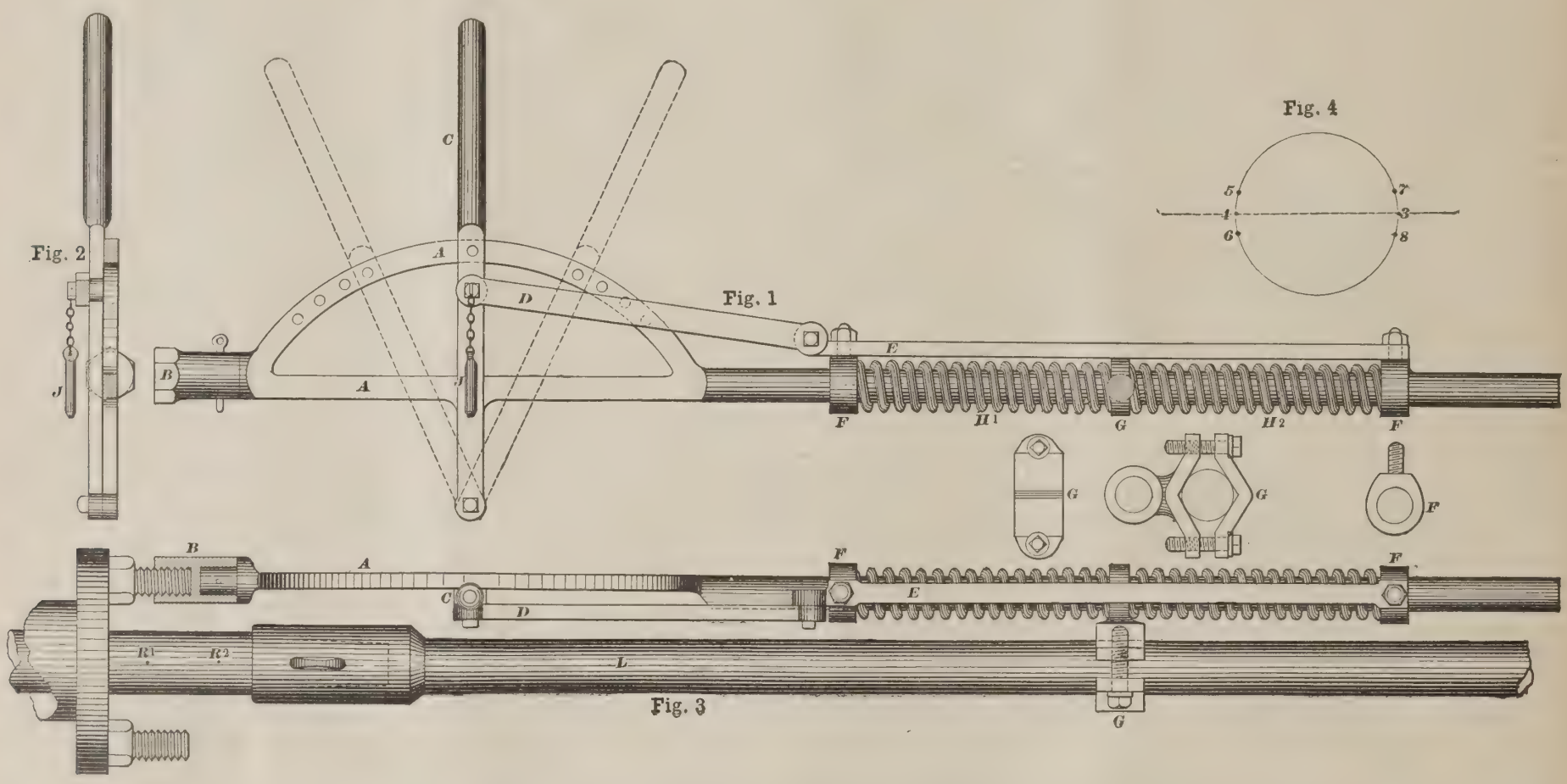
The deadly car stove question is one which has long since been settled in the public mind with the decision that the stove must go. Since the terrible White River Junction disaster, in Vermont, there has not been a moment when, on a popular vote, interested railroad people being excluded from the franchise, the decision would not have been unanimous in favor of abolishing car stoves by rigid law. So far only the New England States and New York have passed laws requiring cars to be heated otherwise than by stoves. Statistics which have been gathered by railroad experts show that it is only where such laws have been enacted that the railroads have been "educated" to meet the public demand. The following table explains the whole situation:

	Railroad mileage.	Passenger cars.	Cars heated with steam. No.	per ct.
United States	160,000	26,000	8,500	32
New York	8,000	4,000	3,600	90
New England	7,000	2,800	1,600	57
Illinois	11,000	2,000	170	8

The New England States and New York have laws requiring the abolition of the deadly car stove. Illinois, which is given as an example, has more railroad mileage than any other State in the Union, and has no law as to car heating. The result is seen in her low percentage of cars heated by steam, which is now generally recognized as the one feasible substitute for stoves. This is a hot subject for hot weather; but it is the season when changes can be made by the railroads to meet the exigencies of winter, and the object of this article is to impress on State Legislatures the necessity of passing laws to enforce the public demand, if the railroads do not voluntarily meet it.—*Exchange.*

A series of brake trials has been concluded on the Belgian State railroads. A train of 50 freight cars, fitted with the quick-acting Westinghouse brake, has been experimented with on the long and steep inclines of the Luxemburg line between Libramont and Jemella. The experiments were a great success in every respect, says *The Engineer*, and this long train, with loaded and empty wagons, was taken down a grade some 18 miles long with the greatest ease. The train was constantly under perfect control, and the speed was kept practically uniform. All present were unanimous in their praise of the improved Westinghouse brake, with which the handling of a train of 50 wagons is as easy as that of an express train of three carriages. The Belgian State railroads intend to put this train into regular service at once, and contemplate the fitting of a considerable quantity of goods wagons with the quick-acting Westinghouse brake. Various other trials were made, all equally successful, and in the quick stops the train was brought to rest within 300 yards, much less than the length of the train, from a speed of 41 miles per hour on a falling gradient of 1 in 62.

The Wells light is about to be tested by the United States Life Saving Department, and Keegan & Halpin, the American agents, New York City, have been invited by the government officials of the life saving service to make an exhibit and test of the light at the Shark River Station, near Jones River, on Sept. 21. The tests will be made under direction of General Superintendent S. I. Kimball, of the life saving department. It is the intention of the government, of course, to adopt this light at all their stations, if it shall prove satisfactory.



Communications.

Favors Iron Axles.

Editor National Car and Locomotive Builder:

Referring to NATIONAL CAR AND LOCOMOTIVE BUILDER, page 117, in the latter part of the paragraph regarding steel axles you quote me as saying: "But on the whole he was decidedly in favor of steel for axles." Now there is some mistake about this. You will notice that the same article indicates that I said that the wear of journals was not satisfactory and that they would not take on a burnish or surface common with iron, and you will observe that the latter portion of this article seemingly contradicts the first part. I think that this reference may have applied to my talk regarding mild steel for crank pins. Referring to same, I believe I did say that on the whole my experience with mild steel case-hardened for crank pins had been perfectly satisfactory. This I see you also refer to in another column on page 126. The latter article is correct.

J. S. MCCRUM,
Supt. M. P. & M.

American Locomotives in New South Wales.

SYDNEY, July 9, 1890.

Editor National Car and Locomotive Builder:

Under this heading in your May issue you refer to 10 engines of the American type which have been built in Scotland. They are all working remarkably well and giving satisfaction; this is fair evidence, I think, that American locomotives so far, have proved to be the best for our use. I must confess that previous to seeing an American locomotive for the first time in the neighboring Colony of Victoria in 1877, I considered there was nothing like an English engine. They had two "Rogers" engines, and I was allowed to take a trip upon one of them and the experience was so satisfactory I could not forget it. Matters rested until 1880, when I was deputed to investigate the working of some Baldwin "consolidation" engines here, over the eight chain curves and one in 30 and 33 grades of the New South Wales lines. My experience was still more satisfactory with these and somewhat startling, for the engines traversed the road with remarkable ease, and the bogie axles radiated true to the centers of the various curves.

I was repeatedly told by certain officers that the best thing to do with the Yankee engines—eleven consolidation and two "American" type—was to lay down a temporary road to the Sydney "Heads" and run the whole lot into the Pacific Ocean; but investigation proved to me that they were the best engines on the road. I reported accordingly, with the consequence that my prospects were blighted for a long time. These engines have been doing our heaviest work from that time to this, and it was decided long ago to build twenty-five more in the colony, and work was actually begun, but the contractor did not complete an engine.

They were worked for years *backward* (on return trips) for thirty miles over reverse curves of 8 ch. radius, with no straight between them. Two firemen were placed upon them for no other purpose than to swell cost of running, as far as I could see. Crossheads were allowed to get loose, or piston rods, until a whole side was carried away. Solid blocks of cast iron, 2½ tons weight, were fixed on foot plates immediately above bogie axle to prevent said axle from "lifting" on inner rail of curves. I think the engines hadn't a friend in the colony but myself. *They are still running as sent out by the makers*, and some have the original steel fire boxes in them. They are unquestionably the best freight engines we have. They run whenever and wherever required; the tire flanges do not wear unduly—bogie flanges keep remarkably good.

In 1884 we required more engines; English makers could not supply them; an American house very expeditiously built and delivered ten as per illustration in *Railroad Gazette* of March 27, 1885; these too have been remarkably successful, one doing the work which it formerly took two engines to do. It was my intention to have three types only for these lines, viz.: the original American of 1877, the consolidation of 1879, and the moguls of 1884, with one design of tender for the whole lot. The mogul could, by simply lengthening the frame, adding a trailing bogie—duplicate of the leading one—be connected to a tank double-ender at will, thus providing for all our requirements for many years to come. We have 88 Baldwin locomotives for working the Sydney tramways, 53 in steam daily, 70 on holidays. The original four sent in '79 are still in use, and there are 12 more now being built in the Colony. We have had many other competitors, all of which have left the field. One named "John Bull," after many trials, was packed up and shipped "home" again. The neighboring colony of Queensland has lately built twenty-five locomotives, *exact duplicates* of the last Baldwin engines sent there. New Zealand has a lot of American locomotives, and from all I can gather, those who have had *experience of them*, and are open to conviction, admit their many advantages. You may guess, sir, how interesting this subject is here, when a reverend gentleman on a Sunday evening delivers his views on it and denounces me from the pulpit. My English critics have credited me with what they cannot prove or show to be true. My only aim throughout has been, like what Mr. Carnegie points out in his recent lecture, "How to Make a Future," viz., to "perform some service for my employers which I could not be censured for not having done."

THOS. MIDELTON.

The Right of a Man to Work when He Wants to.

Editor National Car and Locomotive Builder:

Is it not a little discouraging, not to say tiresome, to pick up a paper and see where some of the members of our many labor organizations have grown discontent with some of the officers that are managing our different railroads, and demand a change of the same, "or we will stop the wheels of progress, and allow no man to make an honest living until our just (or unjust) demands are satisfied." From what I can learn, the more intelligent and better thinking class of workingmen are becoming thoroughly disgusted with such proceedings, and are heartily anxious for some form of legislation wherein they can feel assured, on returning to their post of duty, they will not be confronted by *the committee* and told that they must not attempt duty until "our grievance is settled."

Would any sane man attempt to start an enterprise or business unless he was certain that he could and would be allowed to say who his manager and his subordinates should be? Still we see the men on the Illinois Central Railroad call for the removal of one of the company's best officers, because he wished to place men in positions of trust that he knew to be worthy and competent.

Mr. Webb says: "I have men that are not working to the interest of this company," and makes changes suitably to the company's interest. The consequence is, another "tie up." The community at large and all private enterprise is compelled to suspend operations until this "disgruntled" element is satisfied.

Railroads have come to be necessary factors in our system of life, and the country is entitled to their uninterrupted service, regardless of the disputes between employers and employés.

Cannot government aid be called and license our engineers and conductors so as to make them personally responsible for the delays of traffic, by giving each conductor and engineer a certificate for an examination as to his fitness for holding said position, examination to consist of mechanical ability, train rules, eye sight and bodily ailments, to ascertain if structurally weak—endowing the Board of Examiners with the power of fixing the salaries of these offices. The railway company would then be protected from any outside organization or interference and would secure a far more desirable class of men than they now have, and also do away with the pernicious habit of "seniority."

Then the public would not be compelled to ride behind incompetent or intemperate men and commerce would at least be partially protected.

A READER.

Necessity for Increasing Grate Area.

Editor National Car and Locomotive Builder:

I have read with much interest the report of the Committee of the Master Mechanics' Association on placing fire boxes above the frames, published in the August number of the NATIONAL CAR AND LOCOMOTIVE BUILDER. While agreeing in the main with the conclusions arrived at by the committee, I must admit that the reported scarcity of reliable information as to the relative economy of fire boxes above and those between the frames rather surprises me. Leaving aside all other available sources, the catalogue of one of the leading firms of locomotive builders gives figures that can leave but little doubt that, considering only the question of fuel, the economy of the wide box cannot be gainsaid.

The location of the fire box of a projected engine does not seem to be a complicated point to decide on. We are all probably familiar with the frequently quoted statement of that eminent engineer, D. K. Clark, that the grate area of a locomotive boiler cannot be made too small, provided the rate of combustion does not exceed the limits imposed by physical conditions. As in all the forty or so years that have elapsed since this principle was enunciated nobody, so far as I am aware, has successfully controverted it, we may regard it as substantially correct. The point to be decided, then, is the limit that physical conditions impose.

In the case of steamships, it has been found that the fuel consumption increases in a fairly constant ratio, as the speed is augmented until a certain point is reached. Beyond this any additional speed is gained at a wholly disproportionate sacrifice of coal. My experience on the foot plate has convinced me that this is exactly the case with a locomotive. So soon as the engine is forced beyond its legitimate capacity, the quantity of fuel required to meet the demand for steam is enormously in excess of that usually burned. To my mind, 150 pounds of coal burned per square foot of grate per hour is about as much as any locomotive can consume with a fair degree of efficiency. This figure may be said to be the limit just mentioned, and with it once established, it is a comparatively easy task to decide on the size of grate to be used in connection with a given size of cylinder, diameter of wheel, weight and steam pressure for a given service. From these data it is possible to ascertain how much steam will be required by the engine when performing its maximum work, and knowing the average evaporative power of the particular fuel to be used, the requisite grate area may be determined. For example, take the case of an engine having 18 × 24 inch cylinders, 5-foot drivers and 160 pounds steam pressure, whose maximum work is to be done when running at say 50 miles per hour, cutting off at 6 inch. These figures do not represent any specific instance, but are selected arbitrarily for illustration.

In running one mile a 5-foot wheel revolves 336 times, consequently it would revolve $336 \times 50 = 16{,}800$ times in an hour. As steam is admitted to each cylinder twice per revolution, it follows that with a 6-inch, or one-quarter cut-off, one whole cylinder full of steam is used in that period. An 18 × 24-inch cylinder contains 3.53 cubic feet. This is neglecting the volume of the clearance spaces, but as they would be pretty well filled up with compressed steam of nearly initial pressure at each end of the stroke, with such a point of cut-off, the omission is not at all important. In one hour there would be used $3.53 \times 16{,}800 = 59{,}304$ cubic feet of steam at 160 pounds pressure, supposing steam to be admitted and maintained at full boiler pressure until cut off. This supposition is, of course, not quite correct, but may be regarded as such in this calculation where extreme mathematical accuracy is not sought. The relative volume of steam of 160 lbs. gauge, or 175 lbs. absolute, pressure—the number of volumes of steam produced from one volume of water at 62 degrees F.—is 159, so that to produce the requisite amount of steam, there must be evaporated $\frac{59{,}304}{159} = 373$ cubic feet, or 373×63 (weight of 1 cubic foot of water) $= 23{,}499$ lbs. of water. If the fuel to be used is capable of evaporating 7 pounds of water for each pound burned, it follows that $\frac{23{,}499}{7} = 3{,}357$ lbs. of it must be consumed. This last figure divided by 150, the "limit," gives $\frac{3{,}357}{150} = 22.3$ square feet as the necessary grate area. As a fire box of sufficiently large dimensions to give this area cannot be got down between the frames and axles of an ordinary engine without lengthening the driving wheel base and side rods abnormally, and as running the box up over the back axle to gain in length while the width remains as before is to me a poor expedient (I see the members of the committee are of the same opinion), nothing remains but to put the box on top of the frames.

There are other phases of this wide fire box question of great interest, but as they are ventilated in an able manner in the report it appears superfluous to dilate on them here.

ENGINEER.

Joint Car Inspecting.

BARNESVILLE, Minn., Aug. 14, 1890.

Editor National Car and Locomotive Builder:

Your July number has a letter on Car Inspection, signed by "J. C.," which seems to me rather one-sided. I am a car inspector, and believe in both sides of the question being heard. I frankly confess that I am strongly fortified in my way of thinking since I read in your column that masterly speech delivered by President Briggs's inaugurating the Master Mechanics' Convention at Old Point Comfort. True to the instincts of all scientific knowledge, President Briggs touched a note that will find an echo in the hearts of thousands of your readers. "J. C.," as I see it rebels against all constituted authority without hinting at anything to set his wrongs right. The generally accepted rules for the interchange of cars are replete with information, and in so concise a form that there should be no difficulty whatever of any one retaining an impression steadily on their minds to work in unison with their eye. What standing has J. C.'s reasonings? Suppose, for illustration, that we were working for some one whose every idea was directly in sympathy with our own, and then, for argument's sake, admit a change to take place and some one placed over us whose ideas did not exactly coincide with ours. Are we to deny the right of the rule and change? I suppose not. Consequently, is it any wonder then there should be different opinions regarding car inspection? The very nature of the case demands it. Each road has its own officers at the head of all departments, and surely they are entitled to their choice in the same way as we. Allow each individual to choose his own plan for the house he builds. It matters then very little whether it be the Detroit plan or the Buffalo plan that is at any given point so long as the grand old plan is kept in sight, viz.: To do unto all the world and all men as you would wish them to do to you.

J. C.'s first query is that he fails to see wherein the Detroit plan, as it is styled, can be carried as joint inspection. Well we cannot conceive the idea of any other than joint inspection. It takes two to make a bargain. There must be a deliverer as well as a receiver, and if so there must be

a bond of union and responsibility from the car inspector onward throughout until you reach the chief officers of both companies interested, and whatever details may differ it must in the end converge at the same center. This last surely disposes of J. C.'s second query, viz.: Quick dispatch, safety and a proper discrimination of interest involved, except it be the last clause where J. C. claims the inspector has no one to get even with. Why should he? I have done a little at all kinds of inspection in my day. But honestly the only one I ever had to get even with was myself. Perfection is too fair a flower to bloom in humanity, hence I say that each inspector has plenty to get even with in his own deeds of omisssion and commission. The next is the advantages over the Buffalo System. This too, is altogether wide of the mark. Car inspection, like most other things, cannot be learned theoretically, and the older I get I am the more convinced that duty and time have no parallel at all. How much time can be gained on a train of say from 20 to 30 cars with judicious inspection? I have once or twice in my life been asked to rush inspections, but this I will say, never by any one who knew the first thing about it. Certainly never by anyone charged with the responsibility of inspection. It seems to me then, after all that has been written, the best method of car inspection is for each man to do his duty seasoned a little with moral law, leaving out a good percentage of the sharp practice to be found---even in this Ninteenth Century. Then I think a good deal of the strife and feeling will give place to good will and fair dealing, which after all is now and ever will be the best method of car inspection.

CHAS. RIACH, Car Foreman.

Horse Sense in the Machine Shop.

In the West, or what was the West when I was a boy, a good deal was said about a sixth sense; it was there called "horse sense." I do not find in the list of studies as pursued in the modern schools that there exists a professor of "horse sense;" perhaps such teaching is not now necessary, but it was a great aid to the young chaps who years ago wanted to be engineers and could find no schools of engineering to go to. The possession of this sense, whether acquired by experience or observation, or the result of natural instinct, was of great value to a young man when, as a "cub machinist," he had brought to him a job to do, the like of which he had never before seen, and for which there were no special or even suitable tools. It came into excellent play as he stood and looked over the work to be done, and, unaided, puzzled himself as to how he should go about it.

Many a time have I seen him pull out his worn rule, slide it over the job before him, then chalk a few figures or a sketch on the vise bench, contract his brow, scratch his bent down head in deepest thought, until suddenly there would come to him, like a revelation, a gleam of satisfaction that would light up his face, smooth his furrowed brow, and he would start out to scan the array of old and odd things with which the shop walls were adorned, would tumble out the accumulated scrap which had found refuge under the vise bench, would dig to the bottom of the old scrap pile in the corner, which had in it a little of everything, selecting from one place in it an odd gear wheel, a crank handle from another, to which he would add a short shaft or a long screw; then, with the aid of the carpenter, a lot of blocks and a few planks, bolted together with long bolts made to do duty as short ones by the stringing on them of old nuts slipped to do duty as washers, he would rig up a jigger on some worn out lathe. the like of which had never before been dreamed of. And all this under a sharp cross fire of wit, puns and queries from his mates, who discussed with each other across the shop, in terms and tones meant for his ear, their ideas and imaginings as to what the "cub" was up to, and what he would have when he got through. I have seen, too, the combination of his improvised contrivance, which, tied up with ropes and hitched up with odd pieces of old belts, when started up, did just what the young genius who had gathered them together expected them to do. And I have seen this possessor of "horse sense," with illy concealed pride, walk up and down the shop floor with his hands in pockets, whistling softly to himself, while his shop mates gathered around his conglomerated machine, whispered to each other in subdued tones, "By gosh, she goes."

As I have previously said possibly with the wonderful advance in the art of machine tool construction, this kind of "horse sense" is no longer essential; but, after all, it is the province, or should be, of colleges, and technical ones especially, so to train the minds of their students that, not relying on the theories or formulas alone, they will so use them in connection with thought that they shall become aids only in the accomplishment of what comes before them to be done. I cannot conceive of any education that can supplant thinking in the making of a successful engineer. To think, think, think out a problem is the only true way to successfully solve it. Nothing in the profession you have wisely chosen can ever take the place of hard thinking; schools, laboratories, libraries, lectures and such shop practice as you may have had will be of most valued aid when supplemented by hard thinking.

I do not believe all the theories in the world alone could teach one how to drive a nail. Nothing but practice will do that, and even practice without thought will not accomplish it; you must have both combined. When you drive a nail in a board, what do you do? Do you trust to luck that the swinging hammer above your head shall come down in the right place? Do you concentrate your thoughts on the hammer circling in the air? No. You concentrate your thoughts and eyes square on the head of the nail you want to hit, and no matter where your hammer is or what curves it describes in the air, if your intense thought is on the spot where the blow should fall, there it will fall; if your thoughts wabble and are uncertain, you will miss the nail or knock it sideways. Did you ever see ranged about an anvil a half dozen stalwart strikers who were called up to help the head smith draw down a large shaft or make a heavy weld? If so, you have seen them ranged in a semi-circle before the anvil, each with his sledge hammer poised in the air awaiting the nod of the master smith, who, with a small hand hammer, strikes a light blow where he wants the first sledge to strike, and as each swinging sledge falls in rhythmic sequence on the glowing iron they each fall in the very spot where the hammer of the head smith has last struck, and why? Because each successive striker has fixed his thoughts upon the spot indicated; and as the finished task lies cooling on the trodden earth floor, shaped and completed, it is a beautiful example of what concentrated thought, aided by muscular energy, can accomplish. —*F. J. Holloway at Stevens Institute.*

Selection of Planing Mill Machinery.

While every mill, in order to be profitable, should be stocked with all the necessary machinery that the business will warrant, yet it is not unfrequently the case that some mills are overstocked with machinery, and a large portion is not suitable or well adapted to the kind of business transacted, and the result is that many of the machines are standing idle the greater portion of the time, which is neither profitable nor economical. A mill that depends largely upon a jobbing business needs a somewhat different outfit from one that is connected with a lumber yard, where a wholesale and retail trade is carried on, and where all kinds of dressed lumber is carried in stock. In the former instance, where the machine requires changing with every different job (and that may occur a half dozen times in a day or more), such machines should be selected as are adapted to both heavy and light work, and so constructed that they may be quickly and conveniently changed from one class of work to another with the least delay, while in the latter case there is not much changing, and standard machines may be used that are best adapted to each particular class of work.

For instance, where the business is such that one machine may be run constantly upon matching, there would be no economy in purchasing a machine that has sufficient capacity to plane 24 inches wide and 6 inches thick, while one of proper construction that would surface 8 inches wide and 4 inches thick would cost less money and be more convenient to handle, and at the same time turn out as much, if not more work, in a given time. Such mills are always furnished with one or more heavy, wide machines to do heavy and wide surfacing, and notching 6-inch strips on such a machine, unless under peculiar conditions, is not good practice. In a jobbing mill, where the business will not warrant the purchase of but one planing machine, and all work to be done on it, whether wide or narrow, thick or thin, hard or soft wood, then it is the best policy to select not only a strong, heavy machine, but one that possesses all the latest improvements for quickly changing from one kind of work to another with the least loss of time; and should the business increase so as to warrant the purchase of another machine, then a lighter and less expensive one may be added to relieve the heavy machine from a portion of the lighter work.—*Age of Steel.*

Osgood, Bradley & Sons, of Worcester, Mass., have recently completed 12 freight cars for the Boston & Albany.

The Chicago, St. Paul & Kansas City has placed an order for an entire new vestibule passenger equipment for its limited trains between Chicago & St. Paul, and also on its new line from Chicago to Kansas City.

The Montana Union Railway goes through more general managers than any railway we ever heard of. It is a very poor quarter when a new general manager fails to take hold. The latest victim offered for sacrifice is Mr. W. H. Burns, who has been assistant superintendent of a division of the Union Pacific. Mr. Burns is a pleasant man and we beg to tender him our condolences. We intend going to Butte some some day to make the acquaintance of the man who does the firing to the sacrifices, and if we return safely we shall paint him in his true colors for the benefit of our readers.

A terrible railroad accident happened on the New York, Pennsylvania & Ohio, Aug. 27. A freight train consisting mainly of oil cars was running under a fair head of steam, when the locomotive boiler exploded with a terrific crash that was heard a long distance. Engineer Albert Graham, of Galion, and his fireman, Joseph Murphy, were instantly killed, their bodies being frightfully mangled and scalded with hot steam. The engine fire was scattered in all directions by the explosion, and one of the oil cars was found to be on fire. The wreck of the engine left the other cars at the mercy of the flames, as they could not be detached and moved to safety, and the flames jumped from one car to the other until fifteen were on fire, the blaze lighting up the surrounding country.

Mistakes are often made in selecting the motive power for planing mills. Manufacturers of steam engines and boilers, as a class, are not always the best advisers in such cases, and while they may be also honest in their intentions they all seem to entertain an idea that wood-working machinery requires more power than any other class, and in a majority of cases where it is left to them they will recommend an engine and boiler of nearly or quite double the capacity required, and under such conditions many mills are found that are not only burning all the fuel furnished by the machines, but a large portion of the profits in the wood or coal that is required to make up the difference. Whereas if an engine and boiler had been selected in the first instance of sufficient power, with a reasonable margin for contingencies, the several machines would have furnished sufficient fuel to run them and often some to spare. The fact is too much of the planing mill building, together with the necessary outfits in all parts of the country, has been done by guess, and it would be a hard matter to find a planing mill building that has not been enlarged by additions on one side or the other and not unfrequently on all sides, showing conclusively that they were built too small in the first place and that they had started to do a 60-foot business in a 30-foot building.

A new locomotive has lately been built at the Portland Locomotive Works with a downward draft of the fire. The engine is running on the route from Portland, Me., to Sebago Lake, 18 miles, making 72 miles each day, with baggage and two passenger cars, the record showing gratifying results. This line has many grades of about 85 feet to the mile and the engine has steamed well and made the schedule time without exception. Several changes are to be made in details. The exhaust nozzles have been contracted to 3½ inch openings, and it was then found that some sparks were thrown, necessitating the addition of the usual extension smoke box with baffle plate and screen. The boiler carries 145 pounds steam pressure, and with the above train the cut-off is worked in the first notch from the centre, or about 2 inches of the stroke, which is unfavorable for the quickest steaming.

The engine used less than one-half a ton of coal for the round trip, and less than one ton in 24 hours, including banking over night and getting up steam in the morning. The depth of coal carried on the grate is 10 to 12 inches, and slicing of the fire is not required during the round trip of 36 miles. The engine previously used was a light 40-ton engine, and burned two tons per day of 24 hours. The new engine has taken 19 long cars of coal over the road, with cut-off at 6 inches. It has been noticed that the front end of the grate is insufficiently supplied with air for perfect combustion. To remedy this defect two 4-inch air pipes have been put through the sides of the fire box, with bell mouths opening to the front. The amount of water used has not yet been determined.

In a recent trade review the *Northwestern Lumberman* says:

"The present state of the lumber trade, without reference to future prospects, is in a decidedly prosperous and healthy state. Though the men inclined to catch sight of any cloud that may appear on the fair face of the sky are foreboding trouble from railroad and carpenters' strikes, and are predicting that short crops in sections of the country will a little later in the season reduce the demand, it is useless to anticipate trouble. Prosperity should be enjoyed to the full while it lasts and made the most of; albeit elation should not run wild, but a wise forecast and conservatism should prevail as a temporizer to undue and reckless trading. While manufacturers and dealers should move ahead with wise caution, there is no need at the present time of minimizing the active demand and the firmness of values that characterize production and distribution.

In the western half of the country especially, more particularly that between Buffalo and the Missouri River, and reaching from Lake Superior to the Gulf, the supply of all forest products is in demand equal to the ready supply. In only one locality is there any complaint, and that is in the Saginaw Valley, and even there operators do not agree as to demand and movement, some alleging that it is slow while others proclaim that it is fairly active.

It is a fact worthy of particular notice that there is no lessening the demand for yellow pine or accumulation of stocks. Orders have to be placed far in advance to make sure that they will be filled. In Arkansas and Texas, now that the season for the cotton movement is beginning, it is feared that there will be a serious scarcity of cars to meet the requirements for lumber shipment."

Butler Draw-bar Attachment.

For years it has been acknowledged that the weakest part of a freight car is the draw-bar rigging, and those responsible for keeping cars in running order are aware that accidents to this part of the car send more cars to the repair yard than all other troubles combined. Some years ago the Butler Draw-bar Attachment Company, of Chicago, put on the market an attachment for securing together the draw-bar and the draft timbers, which immediately obtained favor with master car-builders, and has been largely applied to cars with highly satisfactory results.

The owners of the attachment were not, however, perfectly satisfied with the device as it was first brought out, and their engineers have been studying and experimenting for some time to bring it to a more simple form, with the result that they now offer the attachment as shown in our engravings. It will be seen from our illustration that the latest form of the attachment is remarkable for its simplicity of form. An examination of the cuts will show that the attachment consists of only four principal parts which are held in position between the draft timbers by four bolts which extend entirely through both draw timbers and the spring case.

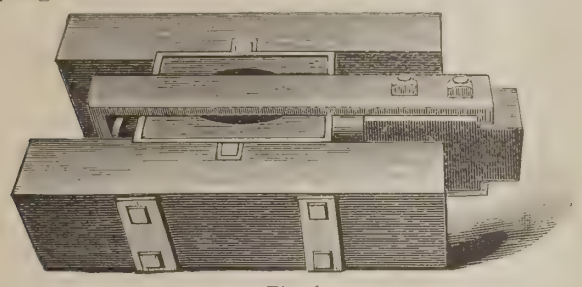


Fig. 1.

Fig. 1 shows this draw-gear complete connected with a draw-bar fitted with a strap. Fig. 2 is a longitudinal section view, with one half of the case removed so that the interior construction will be easily understood, while Fig. 3 gives a detail of the case and the two thimbles. The spring case is made in two parts, and when put face to face these two entirely fill the space between the draft timbers at that point. Each half case is also notched into the face of the draft timber, as shown in Fig. 1. The four bolts which secure it in position pass through the two timbers and the four corners of the case. Light wrought iron plates are placed under the heads of the bolts and others under the nuts, this arrangement being far more satisfactory than the use of washers for each individual bolt. It will thus be seen that the gear and the draft timbers are tied together very firmly.

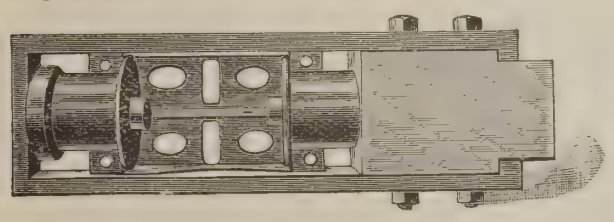


Fig. 2.

Before the two halves of the case are inserted between the draft timbers the two thimbles are put in place in the manner shown in Fig. 2, with the draft spring in between them. The spring is confined in position by the small projections from the faces of the thimbles which fit the interior of the small coil of the draft spring. The collars or flanges on the thimbles limit their motion and also prevent them from being separated from the remainder of the draft gear and lost when the draw-bar is removed. The parts are shown in their normal position in Fig. 2, and when the draw-bar is in tension the rear thimble is pulled into the case by the draw-bar strap, compressing the draft spring until the limit of the thimble's motion is reached by the shoulder on it coming in contact with the end of the case. On the other hand, if the draw-bar is in compression the forward thimble is thrust into the case by the shank of the draw-bar until the limit of motion is reached by the end of the bar coming in contact with the case. It will thus be seen that the draw-bar spring is relieved of the strain due to closing it up entirely. In order to keep the strap in its correct position centrally between the draft timbers, it lies top and bottom in a very shallow groove in the surfaces of the case. This is not shown distinctly in our illustration, but the groove is slightly wider than the strap and not more than 3-16 or ¼ inch deep, being just sufficient to keep the rear end of the draw-bar in a central position.

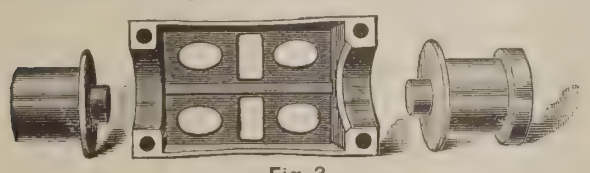


Fig. 3.

Our illustrations show a draw-bar fitted with a strap, but a tail bolt can be used if desired, the only difference being that the thimbles will be cored out for the reception of the tail bolt. It will be seen that this rigging is exceedingly simple and, the castings being made of malleable iron, it is also very durable. The rigging can be made to fit in between any draft timbers, no matter what their spacing may be, providing they are far enough apart to admit the regular draft spring. Its use, therefore, requires no change in the position of draft timbers. The projection into the face of the draft timber is sufficient to take all longitudinal thrusts which any draw gear should be made to stand, and the bolts are well arranged to keep everything in its place.

The Butler Draw-bar Attachment Company informs us that they have lately received large orders for the device, and that the improvements effected on it are meeting with full appreciation from railroad officers.

Drying Lumber Artificially.

If there be one thing more than another, that is attracting and claiming the serious attention of lumbermen throughout the south to-day, it is the question of drying lumber artificially. The main point in doing this successfully, is to provide a sure and effective method by which the moisture can be ejected out of a stack of lumber as fast as it is brought to the surface of each board by the action of heat. It is easy enough to produce heat of some kind or other, but not so easy to distribute it properly, so that each board, no matter in what part of the stack or car it may be located, will get its uniform share of heat. The method most generally resorted to in the past, is what is known as the steam process, or in other words, the radiation of heat from pipes through which steam is forced from adjacent boilers. Some steam kilns have the pipes located at one end underneath the lumber to be dried, while in others the pipes are located in a room by the side of the kiln, and at one end of it, and usually the heat produced by these pipes is blown through the length of a kiln by a blower located in the same room as the pipes. This manner of drying, in the absence of anything better, has been more generally adopted than any other system, but on account of the great cost of these kilns, which includes a large boiler capacity to furnish the necessary extra steam, and the difficulty in drying lumber two inches thick and over, the system has not proved entirely satisfactory to all parties using it.

Advocates of steam drying seem to think that in order to dry lumber it is necessary to force the heat into one end of the kiln and out at the other; at least this is the principle on which all of them have worked, and in order to force the heat through not just simply a room 85 feet long, but a room full of a mass of lumber 85 feet long, they have found it necessary to use different methods. Some use immense stacks, located at the foot of the kiln in order to suck the heated air through the lumber; others use fans or blowers to accomplish the same result; but they all have trouble in controlling the heat, so as to force it around each board, in every part of the car, and in all parts of the kilns. In consequence of this, the lumber is dried unevenly. For many purposes the steam process is very satisfactory, but in drying yellow pine other methods are giving better satisfaction.

Decay of Boilers.

Many explosions of boilers would not have occurred if closer attention had been given to the deterioration of the boiler caused by the general or local decay of the material. A boiler when new may have a factor of safety of six; but it must be remembered that with the beginning of the life of a boiler decay also begins, and that the original margin of safety is gradually reduced by the ever progressing decay caused by corrosion; and if this decay is allowed to progress too far an explosion is sure to take place.

Corrosion does not always attack the surface of steel and iron plates in a uniform manner, hence the decay is more likely to be local than general. This difference in corrosion is probably due to the structural difference in the plates; they are not always perfectly homogeneous, being prevented from becoming so by the nature of the processes of manufacture. For instance, the fibers of iron are welded together by squeezing, hammering and rolling, which sometimes allow the fibers to be separated by thin layers of impurities. The innumerable air and gas cells in steel ingots, more or less perfectly welded together by hammering and rolling, also prevent a perfect homogeneous structure; and it is fair to assume that the imperfect structure of the material is one of the causes of local corrosion. But in steam boilers there are other causes for local decay; for instance, a thin scale tends to protect the plates, but this scale often becomes detached in local places, leaving the clean iron exposed to corrosive action which rapidly progresses. Again, the fibers of the metal may have been loosened by bending, hammering, etc., all of which tends to accelerate corrosion.

Plates are affected in various ways by corrosion; frequently small cavities are formed in the plate, the depth varying from a shallow depression to an actual perforation of the plate. In some cases the cavities lie far apart; in others, they are close together, giving the plate a honeycombed appearance. This phenomenon is called pitting, and may be caused by surface defects due to cinder-spots, etc., but frequently it is due to the intense local action of fatty acids, or other particles of corrosive substances; in some cases the cause of pitting is attributed to the galvanic action of particles of heterogeneous metals.

From the foregoing it appears that, to prevent pitting, good material only should enter into the construction of the boiler, and if pitting then occurs the water should be analyzed, and, if necessary, changed; and greasy substances should not be allowed to enter into the boiler.

Frequently the corrosion forms deep furrows parallel and close to the seams; this phenomenon is called grooving or furrowing. In nearly every case this furrowing occurs under the water line, and in horizontal boilers with lap joints; the grooves are deepest along the horizontal seams. Probably the chief cause for furrowing is a chemical action, because it does not occur with all kinds of water, and it rarely occurs above the water line. But this chemical action is accelerated by a mechanical action which tends to change the form of the shell of the boiler, bending or springing the plates along the seams; but the bending of the plates may break off the incrustation, or even the outside scale of the plate itself, thus continuously exposing a fresh surface of the metal to the chemical action of the water.

The mechanical action may be due to the constantly occurring variation of the pressure, as steam is made or blown off, or it may be produced by the changes of temperature; and if this change of form goes on continually, though ever so slightly, along the same line, the mechanical action of itself must finally produce rupture.

Furrowing is often due to the carelessness of calking, by which the skin of the under plate is cut; careless workmen should not be permitted to use a calking tool.—*American Machinist.*

Mechanics of the Chinese.

It is a remarkable fact (says the *Journal of Useful Inventions*) that the dwellers in the celestial empire, notwithstanding their technical skill and their many important inventions, stand on a very low plane in respect to the natural sciences and their practical application. A recent occurrence illustrates the backward state of science in China. A firm of German electricians, by order of the young emperor, fitted the palace with electric lights. The first trial of the new illumination threw the Imperial Cabinet into a state of consternation, because such results could only be obtained, according to their view, by the aid of supernatural powers—very likely those of evil spirits. It was consequently decided to remove at once the electrical lamps and machines from the palace. In their astronomical conceptions the Chinese stand yet behind the age of Copernicus, believing that the sun revolves around the earth, of whose form and the way in which it is supported in space they entertain the strangest ideas. Of course, in such a country, astrology, soothsaying, and all the rankest superstitions still flourish, and a check can only be expected from the gradual influence of the many intelligent young men who have studied in European universities.

In the ordinary application of practical mechanics, curious things are related of the pig-tailed nation, showing that Chinese education is based on ancient traditions, adhered to with great pertinacity. They display a knowledge of the principles of the lever and the pulley, but in the use of these appliances, known in early antiquity, they remain at the point that Europe passed thousands of years ago. In lifting heavy blocks of marble by means of a scaffold, they tie a rope around a stone, carry it over a beam, and with a bight around another beam below, while a lever is suspended from a higher beam, its short arm connected by a rope, with a rope holding the stone. After one set of men have drawn down the lever, those holding the main rope pull it tight, and a workman above slips down the knot of the lever rope for another hoist.

How to Pile Hardwoods.

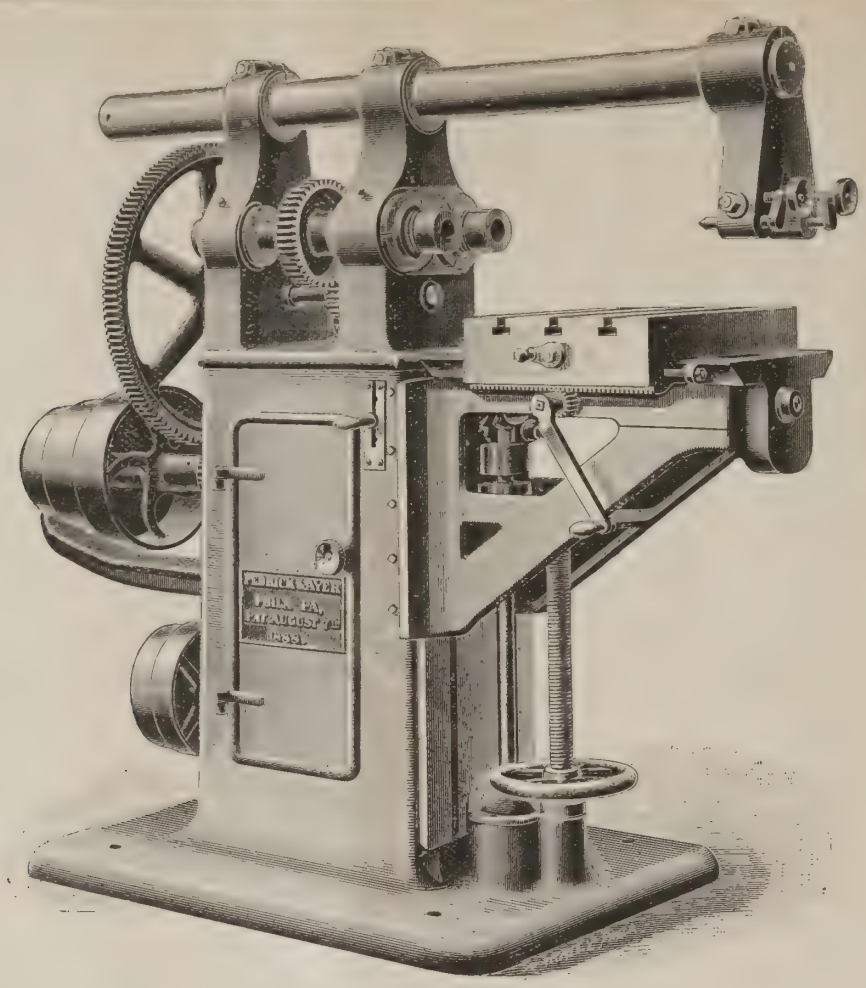
To know exactly how to pile hardwoods to secure quick results and prevent checks stains and mold is more of a science, says the *Timberman*, than most people imagine. For instance, oak, ash, hickory and other tough woods must dry very slowly, and therefore when plled, must be crossed with very thin sticks, placed closely together, in order to get it to dry as slowly as possible. The softer woods, like basswood, pine and poplar, dry more rapidly, and there is not so much danger of checking. No hardwood pile should be more than six to eight feet wide. The front part of the foundation should be at least two feet from the ground, the back about eighteen inches. A space of at least two feet should be left between the piles. Begin the pile by leaving a space between each board, and continue to do so until the top is reached. Place the cross sticks about four feet apart and directly over each other. Put the sap boards with the sap down, and on the outside of the pile. Cross sticks should never be more than three inches wide and thoroughly dry, and the front stick should be placed so as to project about an inch beyond the ends of the lumber. This allows just enough moisture to collect to prevent the stock drying too rapidly on the ends, or faster than other portions of the pile. Where a pile is completed the top should be covered in a substantial manner to protect the lumber from rain and sun. This covering should project beyond each end of the pile and also over each side.

The Chapman Valve Company is making an extensive enlargement of its works at Indian Orchard, Mass.

The New England Equipment Company, of Portland, Me., has been organized with a capital stock of $200,000. James M. Hall is president and treasurer.

The Tyler Tube & Pipe Company will soon start its tube and pipe mill, recently erected at Washington, Pa. The company will make its own skelp iron, having put in an 18-inch 3-high Garrison roll train for that purpose.

The Fowler Steel Car Wheel Company, of Chicago, is now operating its works with quite satisfactory results. The works are running both day and night. Several orders have been booked, calling for 100 to 200 wheels each, and in one case a company gave an initial order for 500 wheels.



DUPLEX BORING MACHINE.

The duplex boring machine which we show in the accompanying illustration was designed and built by Pedrick & Ayer, of Philadelphia, and is intended for boring out two pump cylinders at one time. The distance between the centers of boring bars is fixed for each machine, but in the building of the tool it can be made any distance required. The platen is fed by nut and screw, the latter being driven by a 2½ inch belt. The power feed can be run either way without any change in belting, the gearing being reversed by means of a handle shown near the upper right hand corner of the door in the base of the machine. The feed nut can be turned in or out of contact with the screw by one turn of a small crank. The hand feed of the platen has a quick return for counter boring and the total travel of the table is 14 inches. The knee, or bracket which supports the platen can be raised and lowered, and is securely bolted to the column by bolts whose heads fit in T slots. The spindles of the machine are made of steel, and each has a main journal 3½ × 6 inches, and a rear journal 2 9-16 × 5 inches. A hole 1 1-16 inches in diameter runs through each spindle, and the ends are bored taper to receive cutter bars or other tools, the hole for the same being 2 inches in diameter at the large end, 1½ inches at the small end and 12 inches deep. Along the top of the machine there is a 4¼ inch bar of hammered steel which holds the center supports for the ends of the boring bars, when such support is needed. The platen is 16 inches wide, and 20 inches long. The machine is driven by a three step cone, the largest diameter of which is, 14 inches; the face of each step is 4⅛ inches. The machine is back-geared four to one, thus giving ample power. Its complete weight is about 4,500 pounds. For further particulars inquire of Pedrick & Ayer, 1001 Hamilton street, Philadelphia, Pa.

The Tripp Manufacturing Company, of Boston, have recently made a shipment of their celebrated anti-friction journal bearings to the Chicago & Northwestern Railroad, for passenger service. Also electric car trucks to Concord Horse Railroad Company, Concord, N. H.; Wilkesbarre & Suburban Street Railway Company, Wilkesbarre, Pa.: Citizen's Cable Traction Co., Pittsburgh, Pa. The company is now manufacturing electric trucks for the following roads: West Side Street Railway Company, Milwaukee, Wis.; Citizen's Street Railway Company, Indianapolis, Ind.; St. Paul City Railway Company, St. Paul, Minn.; Tacoma & Stellacoon Railway Company, Tacoma, Wash.; Vancouver Electric Railroad and Lighting Company, Vancouver, B. C. The trucks manufactured by this company, equipped with Tripp's bearings, for reason of simplicity and durability, are in great demand and are being rapidly adopted.

The Egan Company, Cincinnati, write: We do not hear of any complaints whatever in these times of advancement that the wood-worker cannot secure time and labor-saving machines to serve his special purposes. For if there is one concern to study their wants successfully, the Egan Company, of Cincinnati, O., should be credited with the best efforts to reduce the cost of manufacture to the lowest point. Their late mechanisms of American ingenuity of every description for the working of wood are unsurpassed, and are in heavy demand from this country and abroad.

The American Draft and Buffing apparatus has lately been applied to a lot of refrigerator cars for the Chicago, New Orleans & Texas Pacific, also a lot built by the Litchfield Car and Machine Company for the Union Rapid Transit Company and a lot of box cars for the St. L., B. & S. I. Ry., and is being applied to 3,000 cars being built for the Baltimore & Ohio.

We have received from Jenkins Brothers, New York, manufacturers of globe valves, packing, and similar steam appliances, a revised price list for 1890. In sending us the list they write:

A few months since we issued a reduced price list, believing it was for the best interests of the trade to have a lower, list. While we still believe that for the interest of all concerned a lower list is much preferable to the higher lists which are adopted by all merchants in the hardware and steam trades, we feel that we are obliged to conform to the custom of the trade. Our trade demands a higher list, and consequently to please our friends and customers we have returned to the old list, which is universally adopted by all firms in the trade. As it is the prevailing custom to give employment to all we possibly can, we presume it is preferable for all merchants to have price lists of all goods as high as possible, so that they may employ bookkeepers and mathematicians to figure the discounts. Our idea was that the nearer we could get to net prices, the less trouble it would be to bookkeepers, architects, and all others who have to figure the cost of valves in their specifications. It seems that we were very much mistaken in our efforts to establish a lower list. We submit gracefully to the opinion of the merchants of the United States and revert back to our old list.

The Boyden Brake Company have published a fine illustrated catalogue, showing the details of their brake mechanism. There is also a general description of the apparatus, which is prepared in plain, clear language, making it suitable for an instruction manual for those having the brake in charge. Among the parts illustrated and described are: the method of fitting the brake upon the engine and cars, the air pump, the engineer's valve, the pump governor, the passenger brake cylinder, auxiliary reservoir and quick action valves, pneumatic signal, etc. The catalogue will be found of interest to those who are inquiring into the different forms of brakes and are desirous of acquainting themselves with the mechanism of each.

We hear very favorable reports of the Holmes Lubricant bearing as applied to engine and mill work, where bearings were difficult to keep running cool. The inventor of the bearing has arranged to build an extensive plant at Gardner, Me., for the manufacture of the bearing. The intention is to introduce it for cars and locomotive.

Messrs. Watson & Stillman, of New York, have sold quite a number of their improved patent transfer jacks for removing locomotive drivers and trucks during the past month to different railroad companies. They have a record of replacing with these jacks three pairs of drivers under a consolidated engine in 38 minutes.

The Western Light and Power Company, of Chicago, had considerable trouble with the bearings of a Ball engine, which seemed to run hot all the time, before using magnolia metal on this engine. The use of magnolia anti friction metal bearings cured the trouble.

The Buffalo, Rochester & Pittsburgh Railway are using bearings under some of their locomotives made of Eureka tempered copper. The bearings give the promise of being highly durable.

The Universal Radial Drill Co., Cincinnati, report business as being unusually good, and a gratifying demand for their drills for use in railroad shops.

The Glidden & Joy Varnish Company, of Cleveland, have one of the largest and most elegantly appointed plants in the world. They have always bent their efforts on varnishes of the higher grades or better class. Their 30 years' experience in the business gives them a perfect knowledge of its details, and whatever they undertake to do is done well. Their railway varnishes are of finest quality and are highly spoken of. They export largely, to say nothing of their extensive home trade.

The Gold Car Heating Company of New York have put on the market a very well designed pressure regulator which we believe will overcome the obstacles that have been encountered in regulating the pressure of steam to meet the requirements of temperature.

Our Directory.

We note the following changes during last month:

Alabama Midland.—H. S. Haines has been appointed general manager.

Chesapeake & Ohio.—Mr. W. F. Labonta has been appointed purchasing agent at Richmond, Va.

Chicago, Burlington & Quincy.—John Lass has been appointed superintendent of the Galesburg division of the road, with office at Galesburg, Ill., to succeed E. M. Herr, resigned.

Chicago, Milwaukee & St. Paul.—E. M. Herr has been appointed assistant general master mechanic, with headquarters at West Milwaukee, Wis.

Chicago & Northwestern.—G. W. Tilton, superintendent of motive power, died Aug. 17.

Cincinnati, Hamilton & Dayton.—C. E. Walker has been appointed division master mechanic, with headquarters at Cincinnati.

Cincinnati, Jackson & Mackinaw.—F. W. Deibert, master mechanic of the road, has resigned, and A. H. Watts has been appointed acting master mechanic, in charge of the machinery and car departments.

Colorado Midland.—Thomas Saunders, superintendent, has resigned.

Dunkirk, Allegheny Valley & Pittsburgh.—D. Thayer, having resigned the general superintendency of this road, Charles H. Ketcham has been appointed to fill the vacancy with the title of superintendent.

Elmira, Cortland & Northern.—A. A. McLeod r signed as general manager.

Jacksonville, Tampa & Key West.—William Rutherford, who has been master mechanic of the Florida Southern, has been appointed general master mechanic of the above system, in place of E. T. Silvius, resigned. Headquarters, Palatka, Fla.

Illinois Central.—W. H. V. Rosing has been appointed assistant master mechanic of the Chicago & Pontiac division of the Illinois Central, with office at Chicago. Mr. J. C. Ramsey, who has been master mechanic at Memphis, Tenn., has been appointed master mechanic of the shops at Water Valley, Miss., in place of Mr. T. J. Price, deceased. N. D. Wiggins has been appointed superintendent of the Mississippi division at Jackson, Tenn., vice H. W. Clarke.

Intercolonial.—E. D. Laurie has been appointed division superintendent, with headquarters at Stellarton, N. S.

Lake Shore & Michigan Southern.—P. S. Blodgett has been appointed superintendent of the Eastern division.

Louisville, Evansville & St. Louis.—Wm. Buckley, one of the locomotive engineers, has been made assistant master mechanic of the road.

Louisville, New Albany & Chicago.—John Ewan has been appointed superintendent of the Southern division, vice Mr. Loomis, resigned.

Midland (Indiana).—W. H. Hartman has been appointed general superintendent in charge of operating and road departments.

Montana Union.—W. H. Baldwin, Jr., general manager, has been elected president to succeed N. J. T. Dana. His office is at Butte, Mont. W. H. Burns has been appointed general manager.

Natchez, Jackson & Columbus.—W. L. Davis has been appointed superintendent.

New Brunswick.—F W. Cram having requested to be relieved of his duties as general manager, Henry P. Timmerman has been appointed general superintendent.

New London & Northern.—Lewis Beckwith has been appointed master car builder, vice W. A. Beckwith, resigned.

Northern Pacific.—Joseph McCabe, superintendent of the St. Paul division and L. F. & D. branch, has been appointed superintendent of the Pacific division, with headquarters at Tacoma, Wash. A. E. Law, assistant superintendent of the St. Paul division and L. F. & D. branch, has been appointed superintendent, with headquarters at Minneapolis, Minn. C. J. Wilson has been appointed assistant superintendent of the St. Paul division.

Point Defiance.—N. Lawson has been appointed superintendent.

Santa Fe Southern.—T. J. Helm has been appointed general superintendent, vice Charles Johnson, resigned.

St. Louis, Alton & Springfield.—Mr. M. T. Seymour has been appointed superintendent, with headquarters at Alton.

St. Louis, Kansas City & Colorado.—T. H. Riley has been appointed a sistant general superintendent.

Union Pacific.—A. M. Beal has been appointed assistant superintendent at Denver. J. F. Dunn has been appointed master mechanic of the Idaho division succeeding J. S. Hickey, resigned. J. P. Heney, master mechanic, has resigned.

West Shore.—W. W. Wheatley has been appointed assistant superintendent, with office at East Buffalo, N. Y.

Employment.

WANTED.—Situation as a copper smith and pipe worker in a railroad shop. Address H. J. C., Box 273, Milton, Pa.

WANTED by an established business man a gentleman with some means and his time to handle a patent car coupler of the Jenney type. A fortune can be made by right party. References given and required. Address A. C. M., office of this paper.

NATIONAL CAR AND LOCOMOTIVE BUILDER

OCTOBER, 1890.

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The Mobile & Ohio are in the market for 600 cars.

The A., T. & S. F. will again ask for bids for 1,000 cars.

The Delaware & Hudson will soon have bids out for 1,000 cars.

The Boston & Maine are said to be in the market for 1,000 freights.

The New York, Ontario & Western will order some 500 to 1,000 cars.

The Baltimore & Ohio are again in the market for 500 additional freight cars.

The Iron Car Company under its reorganization are pushing ahead on 1,500 to 2,000 additional cars.

A friction car brake to be actuated by air has been invented and patented by Mr. H. H. Westinghouse.

We are advised that the Boies Steel Wheel Works have been kept running night and day for several months back.

The Ohio Falls Car Company has been awarded an order from the Central Railroad of Georgia for 32 new passenger cars.

Six drawing-room cars and ten sleeping cars are now building at the Buffalo shops of the Wagner Palace Car Company.

The Western Railway of Alabama Railroad Company has adopted the Frost Dry Carburetor system of lighting as a standard.

Mr. Thomas L. Chapman, late of the Georgia Central, has been appointed mechanical engineer of the Iron Car & Equipment Company.

The firm of E. D. Smith & Co., of Philadelphia, have the letting of 500 cars for the Western New York & Pennsylvania Railroad Company.

An order for an entire vestibule car equipment has been awarded by the Chicago, St. Paul & Kansas City Railroad for its limited trains between Chicago and St. Paul.

Mr. Thomas A. Bissell, superintendent of the Wagner Palace Car Works at Buffalo, has patented an improved automatic flexible side curtain for the vestibules of cars.

The two 60-ton Wootten freight engines recently built by the D., L. & W. road, having proved so satisfactory, the company is now building a third one at its Syracuse shops.

Fifteen consolidated freight engines are shortly to be delivered by the Baldwin Locomotive Works to the Richmond & Danville road for service on the Georgia Pacific division.

The A., T. & S. F. have placed an order with Brooks for 60 engines, and more from the same company are in anticipation. The company are said to contemplate ordering 100 more engines soon.

The Lehigh Car Company, of Stemton, Pa., have contract for 100 cars for the Lehigh & Hudson River Railroad. They are also just finishing up an order for 400 cars for the Charleston, Sumpter & Northern.

An inventor who has patented an attachment by which a locomotive will be made to sound a gong as a crossing alarm signal, proposes to put an arm on the side of the engine cab extending out about four feet.

The Lackawanna Live Stock Exchange Company have additional equipment in contemplatien. Sample car is being built at Dover, N. J., shops under the supervision and designs of J. N. Baker, master car builder.

The first meeting of the Southwestern Railway Club, which was formed during the convention time at Old Point Comfort, was held at St. Louis on Sept. 25. The meeting took place too late in the month to enable us to publish particulars in this issue.

The Buffalo, Rochester & Pittsburgh have ordered six mogul locomotives from Baldwin's. They would have preferred consolidation engines, but they are to be employed on the division that crosses the Kinzua viaduct, on which the weight is restricted to 100,000 pounds.

A new car wheel has been designed and patented by Mr. R. N. Allen, of Cleveland, O., the aim being to decrease the noise of wheels running on the track. It consists essentially of a cast iron or steel shell with inside radial chambers that are to be packed with fibrous material.

Lumber dealers in Europe who have long depended on Quebec oak as the most select of that kind of timber, have lately begun to patronize southern markets for fine qualities of oak. Large shipments have lately taken place from Mobile, and the business promises to increase very rapidly.

The Cleveland Twist Drill Company inform us that business during the summer has far exceeded their expectation and capacity and that to meet the increase of business they have enlarged the turning department 75 per cent. and made other important additions to the capacity of their factory.

A new form of friction brake for railroad cars has been invented by Michael B. Leonard, Richmond, Va. It consists of a friction shoe and drum mounted on the car axle and operated by a combination of springs and air. The springs tend to put the friction gear into action, and the air is used to keep the brake released.

A patent has been granted to E. E. Gold, New York, for a pipe coupling for railway cars. It is described as a couping head and arm, of a rocking lever carried by the arm and adapted to bear on opposite sides of its fulcrum against the wedging inclines on the other head, whereby its rocking movement may adjust itself to the inclines and equalize the pressure against each.

A car journal box has been invented and patented by Mr. E. W. M. Hughes, of the Fox Pressed Steel Company, Chicago, which will be made of pressed steel. The box is very simple in design and consists of two pieces. It has the appearance of being a highly practical invention. The form will be substantially the same as the Master Car Builders' standard, and the box will be interchangeable with the cast-iron boxes in use.

In discussing the fitness of a candidate for an important position a railroad general manager recently said to the man's friends: "He is not in line with modern progress in the business. He has not attended the meetings of his class, and has not enjoyed the opportunity of knowing the best practice. We cannot afford to appoint a man who is behind the times." The words give significant testimony as to the tendency of the times.

In a paper read before the last meeting of the Institute of Mining Engineers, by Prof. P. H. Dudley, on rail sections, the statement is made that the weight per wheel of locomotives is from four to six tons heavier than it was when steel rails were first introduced and that the weight per freight car wheel is from two to two and a half tons greater, while passenger cars put from three to three and a half tons more weight on the rails. The prevailing rapid wear of rails is in a great measure attributed to this cause and remedies are suggested.

On Sept. 21 a disastrous collision happened in Chicago between two passenger trains. An excursion train belonging to the Illinois Central, crowded with passengers, was standing blocked on the Chicago, Burlington & Quincy track, when a suburban train belonging to the latter company ran into the rear end, telescoping three cars and instantly killing seven persons besides severely injuring many more. No signal was sent out to protect the Illinois Central train, and the engineer of the Burlington train asserts that the train lights were not visible until he was almost close to the fateful cars.

The number of locomotives in the United States on June 30, 1889, is stated by the Interstate Commerce Commissioners' statistician at 29,036, and the total number of cars of all kinds at 1,097,591; while Poor's Manual summarizing the figures up to the end of the last fiscal year of the various railway companies, gives the number of locomotives at 31,062 and the total number of "revenue cars" as 1,090,813. Considering that these two independent statements are for periods a few months apart, they agree remarkably well as to the number of cars, although a difference of over 2,000 in the number of locomotives seems somewhat too large for the difference of dates.

Mr. William Smith has been appointed superintendent of motive power of the Chicago & Northwestern Railway, succeeding Mr. Tilton, deceased. Mr. Smith has been for about three years assistant-superintendent of motive power at Chicago and performed the duties of the head of the department during the sickness of Mr. Tilton. Before coming to Chicago he was master mechanic of the Winona divisions. Mr. Smith is a native of Scotland and was trained as a marine engineer in one of the best establishments on the Clyde. Before settling in this country he was for several years an engineer on steamers belonging to the Cunard line. He is an excellent mechanic and unusually well informed on matters relating to steam engineering.

As we go to press an account reaches us of another fearful addition to the railroad accidents of September. Through the carelessness of a telegraph operator a butting collision happened on the Central Ohio division of the Baltimore & Ohio Railroad, which resulted in the death of eight persons and the destruction of a great amount of property. The telegraph operator who forgot to deliver a holding order to one of the trains is reported to be a young man. He may have been a particularly efficient operator, although he was young, but we are certain that many youths are employed as telegraph operators in charge of train orders who are unreliable and a constant source of danger to the safety of trainmen and travelers.

On some roads any youth can obtain a position as telegraph operator, if he is competent to take and send messages with an approach to correctness. Knowledge of train operating is supposed to be inherent. The wonder is not that mistakes about train orders happen, but that they happen so seldom, considering the careless way telegraph operators are appointed.

Railway ties used by the Eastern Railway Company, of France, are principally of oak and beech, and before being used are creosoted by the following process: After being seasoned in the open air they are placed for 24 hours in a dry kiln with a temperature of 176 degrees, Fahr. They are then placed in a large hermetically sealed metal cylinder, from which the air is exhausted, and dead oil allowed to flow in under a temperature of 176 degrees, Fahr., under pressure. When the oil ceases to flow in it is forced in by a pump up to a pressure of 83 pounds per square inch, which pressure is kept up for an hour or more when the excess of oil is allowed to flow off. The oak ties absorb from 2.4 to 2.7 u arts per cubic foot and the beech ties from 8.7 to 10 quarts per cubic foot. This method has been in use by this company upwards of 25 years and the results are quite satisfactory. After 15 years of service the sleepers taken out have been 15 per cent. for creosoted oak and 50 per cent. for creosoted beech. Timber for structural and rolling stock building purposes might be advantageously treated in this way.

The agitation on the New York Central Railroad that followed the strike ordered by the Knights of Labor has settled down, and business is moving along on the road about as smoothly as if no difficulty had happened between the company and a portion of its men. The agitator class of railroad men were in hopes that reflections would be cast upon Mr. Arthur, grand chief of the Brotherhood of Locomotive Engineers, for the conservative policy he adopted during the strike, but as usual they were disappointed. A large union meeting of Brotherhood engineers was held in New York on Sept. 25, and resolutions were unanimously adopted approving the action taken by Mr. Arthur during the strike. Mr. George Royal attended this meeting at the urgent invitation of several divisions, and was the spokesman of those who were anxious to give voice to the policy that the locomotive engineers refrain from union entanglements with other labor organizations. The highly eloquent address which Mr. Royal delivered exercised a powerful influence in bringing support to the resolutions sustaining the head of the order.

During a recent visit to the Old Colony Railroad shops at South Boston we found Mr. Lauder and his assistants very busy with the repair work following a season of unusually heavy passenger and freight business. They intend, during the winter, building several of their standard fast passenger engines of the design illustrated in the National Car and Locomotive Builder of March, 1887. These engines have done extraordinary good work in pulling the heavy fast trains, for which the road is noted, and it has been asserted that there is nothing to equal them in New England. A considerable portion of the work for the compound locomotive which Mr. Lauder is building has been got out and it is expected that the engine will be ready before the year is ended. The engine, as our readers are aware, is of the two cylinder type. The details of the engine appear to have been well worked out by Mr. F. W. Dean, who assisted Mr. Lauder in designing the engine. A starting valve will be used which has been invented and patented by Mr. Dean. The engine has a particularly large steam receiver, the increased volume being attained by putting two widened oval reservoirs in the smoke box, the same being parts of the horseshoe steam pipes.

Tests of the Baldwin Compound Locomotive.

The Baldwin Locomotive Works have published a pamphlet giving particulars of a series of tests made by Mr. George H. Barrus to determine the relative economy of a compound locomotive built by the firm and an eight-wheel simple engine of substantially the same capacity and size. The annexed engravings illustrate the compound locomotive, which has four cylinders, two on each side, arranged with the high-pressure cylinder set on top of the low-pressure cylinder, both being supplied with steam through one piston valve, shown in section. The pistons of both cylinders connect with one crosshead.

The piston valve controls the distribution of the steam for both the high and the low-pressure cylinders. The valve is nine inches in diameter on the outside, and it works in a bushing which fits a cylindrical opening in the saddle casting. The ports in the bushing are cut into a number of small openings by means of bridges, in order to secure proper action of the packing rings, with which the various edges of the valves are provided. There are eight of these packing rings, and the number of openings in the bushing for each port is 19. The steam received from the steam pipe, leaving the smoke-arch, passes through two branch openings in the saddle casting to either end of the cylindrical space in which the valve travels, and thence into the high-pressure cylinder. The exhaust from the high-pressure cylinder is discharged first into the interior of the valve, which is hollow. From the end of this space, which is 5¾ inches in diameter and 20 inches long, it emerges and passes into the opposite end of the low-pressure cylinder. The exhaust from the low-pressure cylinder passes around the neck which is formed in the center of the valve, and thence it is discharged into the exhaust pipe. By this arrangement of the valve the low-pressure cylinder is supplied with steam at the same time as the high-pressure cylinder, although both pistons are moving in the same direction.

In order to admit live steam into the low-pressure cylinder when the engine is started from a state of rest a connection is provided, by means of a one-inch pipe, extending between the two ends of the high-pressure cylinder, and this pipe is provided with two valves operated by a lever in the cab. When these valves, which are called "reducing valves," are opened, steam of reduced pressure is admitted behind the piston of the high-pressure cylinder, and by this means to the working end also of the low-pressure cylinder.

The design of the compound engine was worked out by Mr. S. M. Vauclain superintendent of the Baldwin Locomotive Works. The engine tested was the first of the kind which has been built.

THE TESTS.

The tests were made on passenger trains under the conditions of regular service on the Baltimore & Ohio Railroad. They were in two series, the first series extending from April 30 to May 9, and the second series from May 27 to June 2. The first had for a principal object the comparison of the two engines, and the test of each engine embraced four round trips between Philadelphia and Washington, made on successive days. The days on which the compound engine was used were those extending from April 30 to May 3, and those on which the standard engine was used were those extending from May 6 to May 9. The train on which the tests were made was the Washington Limited Express, which leaves Philadelphia at 8:15 o'clock A. M., and arrives in Washington at 11:15 A. M. The return trip was made on the Limited Express, leaving Washington at 4:20 o'clock P. M., and arriving in Philadelphia at 7:20 P. M. The second series of tests was confined to the compound engine, and it embraced three runs from Philadelphia to Baltimore, on the accommodation train which leaves Philadelphia at 6:40 A. M., and arrives in Baltimore at 10:35 A. M. The return trip was made on the express train which leaves Baltimore at 3:40 P. M., and arrives in Philadelphia at 6:15 P. M.

The data determined on the tests consisted of the weight of coal used for the entire trip; the weight of water used for the entire trip, as also for various periods of the trip; indicator diagrams from each end of each cylinder, and, so far as possible, other information of an incidental nature which is needed for a complete analysis of the performance of a locomotive.

Very exhaustive tests were made, and they were evidently conducted very carefully and accurately recorded. Want of space prevents us from publishing the particulars. The coal used was carefully weighed and the water was measured with sufficient accuracy to secure an even comparison between what was used by the two engines. Indicator diagrams were taken at short intervals, the character of the steam supplied was tested by the Barrus Universal calorimeter, the vacuum in the smoke box was ascertained by a water gauge, and an attempt was made to find out the smoke box temperature, but the pyrometer proved to be unreliable. The average speed of the train on which the comparative tests were made was 43 miles per hour, and a speed of about 60 miles per hour was frequently attained. The indicator diagrams were taken with Crosby indicator on one side and Tabor indicator on the other. The speed was determined by the use of a Schaeffer & Bundenberger tachometer.

The engineers handled the locomotives to suit themselves, and throttling the steam was practiced to a considerable extent. No records were made of how the throttle lever was handled.

CONCLUSIONS.

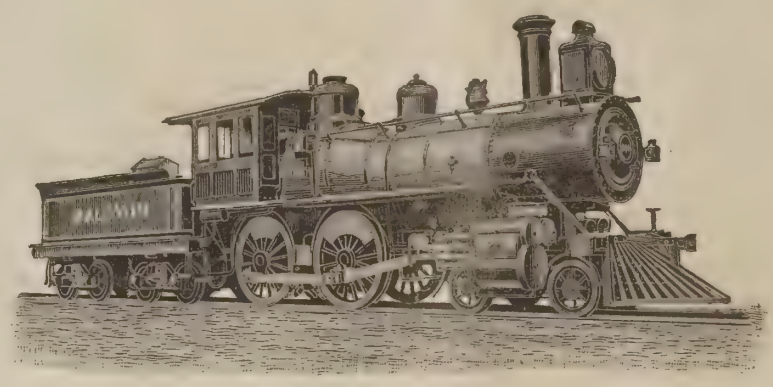
The following review of the tests is made by Mr. Barrus:

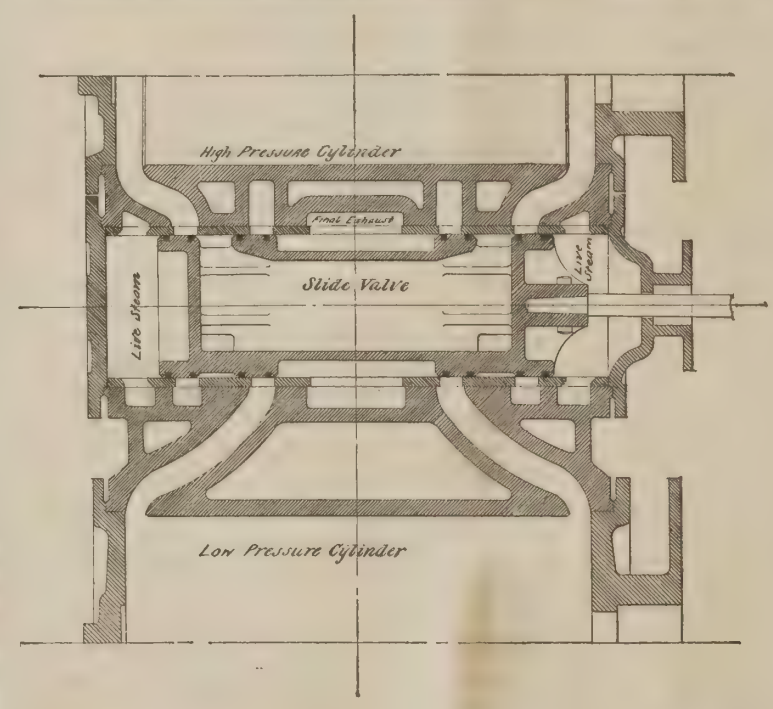
1. The average consumption of coal for four round trips between Philadelphia and Washington was 14.9 per cent. less in the compound engine than in the standard engine, and the consumption of steam per horse power, during the selected period of the runs which have been analyzed, was 5.5 per cent. less in the compound engine than in the standard. The increased saving of coal over that of steam appears to be due to the improved action of the exhaust blast upon the fire, which the compound principle secures. These results were obtained under the severe conditions of service required in moving an express train at a rate of speed varying from 50 to 60 miles per hour.

2. The compound engine is more economical in the use of steam when running at slow speeds than at high speeds. The steam consumed when running at a speed of 257 revolutions per minute (50.4 miles per hour) was 25.69 pounds per indicated horse power per hour, while that at a speed of 176 revolutions per minute (34.5 miles per hour) was 20.86 pounds per indicated horse power per hour. The difference between these quantities is 19 per cent.

3. The increase in the consumption of steam which accompanies an increase of speed in the compound engine is due to loss produced by the greater frictional resistance which the steam encounters in passing through the various ports leading to and from the cylinders. This loss appears to be more serious in the compound engine, with its double system of cylinders, than in the standard engine, with its single cylinder; and the conclusion may at once be drawn that the compound engine, in its present shape, will secure a greater saving of fuel when used on heavy express trains running at medium speed, on accommodation trains, and on freight trains than when used on fast express trains. The tests furnish ample reason to expect a saving of coal on freight trains, and on accommodation passenger trains making frequent stops, of not less than 30 per cent.

4. In the construction of future engines, improvements in





the form, size, or arrangement of the passages which conduct the steam from one cylinder to the other may doubtless be effected, which will reduce the frictional loss noted and increase the economy beyond that now obtained. With the same end in view, the use of a larger driving-wheel, with a proportionate increase in the stroke of the piston, thereby reducing the number of revolutions without changing the speed of the train, would be advantageous. Still another improvement may be made by reducing the size of the high pressure cylinder to 11 inches, and carrying a longer cut-off, the boiler pressure being increased at the same time, if found necessary, to 180 pounds. By this means a wider port-opening may be obtained without reducing the degree of expansion.

5. In conclusion, the performance of the compound engine, as to running features, compares favorably with the locomotive of the older type. It steams freely, and without undue exertion on the part of the fireman. It starts from a state of res quite as promptly as the standard engine. No difficulty is encountered in moving the fastest trains with the engine on schedule time and, when required to do so, in making up a reasonable amount of lost time. Its ability to make time is well shown by the fact that, during the tests, the terminal stations at Washington and Philadelphia were reached, on four successive days, either on time or a little ahead of time, without a single exception, although the train was frequently delayed at stopping places. The effect of the reciprocating parts, although weighing more than those of the simple engine, appeared to be inappreciable. The jar produced by these and other disturbances, so far as it could be measured by the feelings of a person riding either in the cab or on the pilot, was no greater in one engine than in the other.

Altogether, judging from the manner in which the new engine operated during the progress of the tests, it meets all the mechanical requirements demanded by a successful locomotive.

A car door with a peculiar arrangement of slat openings made to admit air and at the same time to exclude rain has been patented by Thomas Eubank, of Little Rock, Ark.

New South Wales Wants Pullman Cars.

Late papers from New South Wales give us particulars of a curious transaction that happened there a few months ago. An American named William Pullman was traveling in Australia and pretending to be an authorized representative of the Pullman Car Company of Chicago. The Railway Commissioner of New South Wales who is a government official having authority analagous to that exercised by our railroad presidents, invited this Mr. Pullman to enter into negotiations about supplying Pullman cars for use on the New South Wales railways. Particulars of the resulting negotiations are published in a colonial paper as follows:

Several interviews took place, in which Pullman represented himself as armed with full powers to negotiate on behalf of the firm. Proceedings advanced so far that upon Jan. 6 last the heads of an agreement were drawn up, under which the Pullman Company was to receive 3d per train mile for the use of the carriages for 10 years, and after that 2d per mile, the extra fare for the use of vestibule cars and berths to be limited to 8s. per passenger. It was further provided that should more favorable arrangements be made with the other colonies, this colony should have power to vary this agreement. Members of Parliament and such other holders of free passes, as the Commissioners might decide, to use the vestibule train free of charge, except for refreshments. Other complete regulations were provided for, and the Railway Commissioners were to have the right to purchase the cars at a price of £6,000 for each dining car, and £4,000 for each drawing-room car, allowance to be made for wear and tear. After considering the matter, Pullman decided that if the cars were to be purchased he must have £2,000 profit on each, but, on the chief commissioner refusing to agree, he reduced this proposition to £1,000 each car, and this was accepted by the commissioners. On Jan. 31, after further consideration, this agreement was modified in several minor respects. And there the matter rested. Before the agreement was prepared for signature the Railway Commissioners wanted to see Mr. Pullman's authority to act for the firm, but that gentleman seemed strangely chary to produce it. No satisfaction having been obtained from him, Mr. Eddy cabled to George Pullman, Pullman City—"Negotiations with Wm. Pullman; are you preparing agreement?" The reply came back short and sharp on the same day—"Party unknown," followed in the next mail by a letter intimating that the only foreign representative of the company was in London, that the party, Wm. Pullman was unknown, and that the company would thank the commissioners to remit $13.20, the cost of the cablegram sent in reply. The money was remitted. In the meantime, on April 26, the Pullman Company had written: "The first intimation we had that anyone claiming to represent the company was in negotiation with your commissioners in regard to the building by the Pullman Company of sleeping cars for service in New South Wales came to us in Associated Press dispatches. This was confirmed by your cable message of March 6. As you know we promptly replied to your despatch, and advised you that the person so claiming to act for this company was unknown to us. I regret very much that your commissioners were so imposed upon by one who had absolutely no authority to make any dealings on our behalf, and of whom this company had no knowledge whatever."

Block Frogs and Guard Rails.

Another State railroad commissioner has found it necessary to send out to railroad companies an emphatic protest against the prevailing carelessness in filling frogs and guard rails to prevent switchmen getting injured in the performance of their dangerous duties. This time the note of warning is raised in Ohio. Commissioner Norton directs attention to the habitual violations of the laws requiring frogs, switches and guard rails to be filled and intimates that a change of practice must be made. If he would have the real manager of some road indicted and punished for manslaughter when a homicide takes place through a switchman getting his foot caught in an unprotected switch, its influence would be much more impressive than any number of protests.

Mr. Norton's notice to railroad companies concludes: The safety of the employés demand it and this department must insist upon a strict and honest compliance with the law, to the end that all frogs, switches and guard rails, wherever used (except upon bridges) must be properly filled and continuously kept so. As to the material or device to be used, this department desires to be understood as not dictating beyond this, that it must be something effectual, lasting and fixed, with a permanency that gives the safety and security contemplated by the law. Your earnest cooperation is sincerely asked for to aid this department in making complaints from the employés of railroads unnecessary upon this question. The inspector of this department will make examination, and report all violations of the law to this office.

Rigid Center and Swing Beam Trucks.

At the September meeting of the Western Railway Club a discussion on the above subject was introduced by Mr. P. H. Peck. He said:

I have never had experience in maintaining the two kinds of trucks on cars, but have had some experience with them on tanks, and have found the result largely in favor of rigid centers. My observation and records of defects in cars show more truck defects with the swing beam than with the rigid beam. The records of expense of repairing trucks also show more repairs made on swing beam trucks than on the rigid. As near as I can estimate, there are not less than 10 per cent. more defects shown on our records in the swing beam than in the rigid beam truck. Most of the defects in the swing beam truck were, however, where wooden transoms were used and hangers slotted through the transoms. I also found a great many of the lever hanger pivots bent, with keys lost out of them, which is liable to let the spring plank down between the rails. This frequently derails the cars.

I find that, after a car has run some time with iron transoms, the transoms are more or less widened at the top, bending the top swing hanger pivot, and bending the top of the iron transom at the pivot bearing; and when this bending is bad, the truck frame has to be taken to pieces and rebuilt.

A great many of the swing beam trucks are built with a short side bearing, and when the spring weakens on the trucks the side bearing on the body of the car rests on the wooden transom, which will not allow the car to curve on any short crossover. I also find more loose and broken center castings and truck sides on swing beam trucks.

The first cost of the swing beam is more, and in service there are nine different parts on each truck that are liable to break or give out (disabling the car) to one on the rigid. We have four hangers, four rocker pins, and spring plank, each of which, if broken, is liable to derail the car. In the rigid beam we have only the spring plank.

In regard to flange wear, I have not noticed much difference, but think flange wear in a great many cases is not due to the style of truck, but to an imperfect side bearing on truck and car. I do not see how some trucks curve at all with the side bearing they have. Only a few days ago I saw a small wrought strip of iron on a wooden bolster, the side bearings on both sides of car bearing hard against the strip until it was imoedded in the bolster half an inch. Such a car necessarily would be hard on flanges. I have also seen cars derailed with all the wheels of the car near the rail, having run only a few feet. In these cases it was impossible to put the car on the track with frogs until the car was raised and strips well oiled put between side bearings in order to let the trucks go over the frogs to get on the rail.

I think that many times we have cars off the track in the yards when no cause can be assigned why they left the rail, when the derailment was really due to an imperfect side bearing, one being high on the trucks with no weight, and some being light and carrying all the weight and fastened with two small lag screws which are always loose. Some are thin cast iron, and these are invariably broken if on wooden bolsters.

Mr. RHODES: Our experience with the swing beam and the rigid truck on the C., B. & Q. has led us recently, on the score of economy, to adopt the rigid truck in lieu of the swing beam truck, and to gradually abandon the use of the latter, as they require general repairs. We found that the parts of our trucks that were constantly needing more repairs than others were the hangers and the axles which are attached to the hangers. These axles were breaking so frequently that the question was raised whether we should not increase their size, and in raising that question there was incidentally brought up the question as to what was the use of the hangers. Why have them if they broke so frequently? This is a question which comes up often in mechanics. Take locomotive rod connections, for instance. We used to shear a great many bolts, break straps and lose keys, and in considering the remedy for this the question was raised, "Why have them at all?" If we can do away with the bolts, we won't have any bolts to shear. If we can do away with the keys and straps, we won't have any keys or straps to cause delays and expense. This same line of investigation we have applied to our swing beam trucks. Instead of increasing the dimensions of the hangers and axles, we decided to do away with them. The matter was considered on our proprietary lines as well as on the C., B. & Q. proper, and there never was a question brought up on the C., B. & Q. that was so unanimously decided as the abandoning of the swing beam truck. There was hardly a man that stood up to defend the swing beam truck. We have hundreds and hundreds of cars going over our lines every day with rigid trucks, so that we have had an ample experience with both kinds.

The question raised by Mr. Peck, as to whether there is not more flange wear with rigid trucks, I think can be answered pretty plainly by reminding you of the result of the Burlington brake tests. In the train resistance tests were cars fitted wholly with swing beam trucks, and some fitted wholly with rigid trucks. The train that offered the least resistance going around the curves and grades of that three-mile run was a train fitted with rigid trucks.

One question that was asked when we looked into this matter was: Why is it that the swing beam truck has become so generally used in the West and is so little used in the East? The answer seemed to be that some years ago, when the roadbeds were not kept up so well as they are now, and when people were apt to be carried away by the advantages of some claim that one railroad might make over its competitors, the claim that trucks of a given road rolled smoothly over rough roadbeds owing to their swing beam feature, was used as a sort of incentive for people to ship their goods, especially stock, over that road, and other roads consequently put in the swing beam truck. But so far as our road is concerned, this line of argument has been shown to be a fallacy, and we have come to the conclusion that it does not cut any figure, and that the truck that requires the least repairs is very apt to be the one that has the fewest parts to it. It will be asked, Are you not sometimes required to run your cars at a very high rate of speed, and is it not advisable to have your truck constructed so that it will run at that high rate of speed? We say yes, and we consider our rigid freight truck safe for any speed and any train on our line. In confirmation of our belief in this, I may say that it was only the other day at Chicago that I saw one of our fastest passenger trains going out of the city, and immediately back of the engine there was one of our new freight cars fitted with our rigid trucks. This also tends to illustrate a point that is constantly presenting itself, viz.: the similarity of the two services, especially the fast freight trains and heavy through passenger trains. We have got to have our engines and the running gear of our cars, including brakes and couplers, pretty much the same for both services; at any rate they must be safe to go into either service, and we believe our rigid freight truck to be safe in either.

Mr. PECK: What I observed in the way of flange wear was mostly on old cars, where they had been allowed to run a long while in service. I found them bearing hard on the side bearings, so that it was almost impossible for the car to curve.

Mr. G. W. CUSHING: My experience has been rather in favor of the vibratory or swinging motion truck. In regard to the flange wear of the wheels, I am quite certain it would be very much less with the swing motion than it would be with the rigid truck. The same would be true in regard to the wear of oil boxes and brasses.

President HICKEY: I remember my experience some year ago on a road, with which I was then connected, that adopted a swing truck for an engine truck. They made several and put them into the fast passenger service, and ran them six or seven or perhaps eight months. During the time the expense of trucks was increased at least 40 per cent.; I think it was more than that. The swing beam not only added to the cost of repairs of trucks, but it loosened the boiler fastenings. They were finally obliged to throw the swing trucks out and go back to the old style, whereupon they had much better results. I was slow to believe that a rigid truck for a freight car was better than a swing beam, until some three or four years ago we bought a lot of cars for the ore service, all of which had swing beam trucks. Shortly after we received the cars I looked into the wearing parts and I noticed that we were having a good deal of the trouble with the axles and hangers spoken of by Mr. Rhodes. Not only were many of these broken, but many were bent, and in order not to cause too much delay I was obliged to introduce thimbles — pieces of pipe tubing — that would go on to these axles and keep the hangers the proper distance apart. I rode on the freight trains several times, and when going at a speed of perhaps 18 or 20 miles, the loose cars would sway so that they would appear to string all over the track. They were not only destructive to themselves, but they were equally destructive to the track. Shorly afterward we got an order to build a large number of 60,000-pound cars. I looked over the situation carefully and I got our master car-builder to consent to a rigid truck. I got figures on both trucks, the swing beam and rigid, from car manufacturers, and I found that they would build a rigid truck of equal capacity as a swing truck for from 16 to 17 per cent. less. I have found that there is not less than 25 per cent. less cost for repairs of rigid center trucks than of swing beam trucks. I reached my conclusions very slowly and was slow to adopt them, thinking that the cars would curve better with the swing beam and that they would be more easily hauled. I did find that the flange wear would have to be looked after very closely. I investigated the cause of the wear and found it to be the fact that the upper transoms of the cars were not properly sustained; when the load came they would settle down on the side bearings and bind, and the wheels were, therefore, quite subject to flange wear. But with side bearings having some margin of safety, I think you will have no trouble with the rigid truck, and I believe it is the coming car truck. I have had similar experience with locomotive tank trucks.

Tests of Varnish.

At the Boston meeting of the Master Car & Locomotive Painters' Association, Mr. A. T. Schroeder, master car painter of the Chicago, Milwaukee & St. Paul, read a paper in which the following interesting tests were described:

Mr. J. N. Barr, our superintendent of motive po ..., being of the conviction that it was the only way to arrive at conclusions in adopting standard material, instructed me to test all of our paint material, and, as varnish is one of the most important materials, it was concluded, in order to obtain the relative merits of the various varnishes, to finish every car, wherever practicable, with two varnishes; that is to say, one-half of the car with one brand, the other half with another brand, in such a way that every long side of a car should show the two varnishes as they meet in the center. Thus it would be plainly demonstrated by the material itself which of the two, in a certain length of time, would prove to be preferable.

From the fall of 1886 to the close of 1889 more than 200 cars were finished in this way, and altogether 17 different brands applied. It was clearly demonstrated that several of these, to put it mildly, were not at all adapted for that purpose, and they consequently had to be discarded; finally the brands were reduced to a limited number, and one of these, which had proved so far to be the best one in all respects, was put in competition with all the remaining ones. Up to now we have not arrived at a final conclusion, because of the many circumstances to be taken into consideration, but during my experience in testing varnish in this manner facts were revealed of which I never heretofore dreamed.

Our standard for sleeping, dining and parlor cars is Pullman color; the ornamentation applied on the flat paint and the car then finished with one coat of rubbing and two coats of finishing varnish. Passenger, baggage and other cars are painted yellow, last coat varnish color, of the formula of one pound paste body color, 1½ pounds rubbing varnish and two ounces turpentine; then ornamented and finished with two coats finishing varnish.

At the suggestion of Mr. Barr we took a few cars and varnished them with one brand for the whole car, but used for one-half of the car one coat of rubbing and one coat of finishing varnish, and for the other half two coats of finishing varnish, in order to ascertain which process would give the best results. This was done accordingly. After a very short time the difference was so manifest that the one-half on which rubbing varnish had been used lost so much of its lustre that it showed a marked dividing line in the center of the car, and after a few months longer the contrast had so increased as to make it appear as though originally only one-half of the car had been varnished. Naturally such a car was immediately called in for revarnishing. On other cars which had to stay on the road from 16 to 20 months such difference could not be distinguished, as all lustre had disappeared, yet I observed that the half with the rubbing varnish over the gold was in a more advanced state of decay than on the other half, where two coats of wearing body varnish had been applied. Furthermore, a difference in favor of the latter was found when I applied the so-called oil test, of which I will make mention later on.

Now about these cars on which two brands were used; each car finished with two coats of wearing body varnish. In regard to the lustre it was very difficult to discover any difference, whereas on the yellow car it was found, after careful investigation, that some brands were superior in transparency. Yet I think this is only a matter of secondary consideration, as durability is certainly the most important object.

The oil test is as follows: After ten months of service a car arrives at the shop; both varnishes have the same appearance and surface, and no difference in the two varnishes can be noted. I then have a vial filled with half-and-half boiled and raw linseed oil, and a two-inch long round wire nail, driven into the cork and extending into the oil. With this nail I take out a drop of oil and apply it on the varnish, making drops of various sizes, so that I may be able to note how much, if any, of this oil will penetrate into, or spread out on, the varnish. After four or five hours I find that on the one varnish the oil has entirely penetrated and scarcely left a visible trace, whereas, on the other varnish the oil remains as applied, thus showing that no absorption whatsoever has taken place. Which of the two varnishes should have the preference? Which one will protect paint and wood best I need not say.

On another car, one-half is in best condition, paint as well as varnish; but on the other half long cracks, running with the grain of the wood on the panels, draw through them, which, upon examination, are found to extend deep into the paint. Is the paint responsible for the cracking? I cannot believe so. The whole car was painted with the same paint at the same time and under like conditions. But, supposing that the whole car had been varnished with that one brand, would not the painter have to carry the blame? How could he prove the contrary? Who would believe him?

Of course, by testing varnish in this manner, many cars were utterly spoiled, and we had to remedy the evil as quickly as possible. It would be useless to recite the results of all of these various cases; suffice it to say, that it has brought to light many interesting facts, and although I was not able to examine all of these 200 cars, a great number of them enabled me, upon examination, to form a correct opinion as to the merits of the material.

Railway Master Mechanics' Committees.

The following circular has been sent to the members of the Railway Master Mechanics Association:

COMMITTEES FOR CONDUCTING BUSINESS FOR THE YEAR 1890-91.

No. 1. *Exhaust Pipes, Nozzles and Steam Passages.*

Investigate best form and size in proportion to cylinders.

Committee: C. F. THOMAS, A. W. GIBBS, L. C. NOBLE, F. C. SMITH, JOHN Y. SMITH.

No. 2. *Testing Laboratories, Chemical and Mechanical.*

Committee: GEORGE GIBBS, PHILIP WALLIS, G. W. WEST, L. S. RANDOLPH, D. L. BARNES.

No. 3. *Advantages and Disadvantages of Placing the Fire-box Above the Frames.*

Committee: FRED. B. GRIFFITHS, JAMES MACBETH, W. A. FOSTER, A. G. LEONARD, LOUIS F. LYNE.

No. 4. *Relative Value of Steel and Iron Axles.*

Committee: JOHN MACKENZIE, J. S. GRAHAM, JOHN S. COOK, E. B. WALL, THOMAS SHAW.

No. 5. *Purification or Softening of Feed Water.*

Committee: W. T. SMALL, HARVEY MIDDLETON, A. W. QUACKENBUSH, J. B. BARNES, JOHN W. HILL.

No. 6. *The Present Status of the Car Coupler Question.*

Investigate whether this Association can indorse the action of the Master Car Builders' Association from a mechanical standpoint in recommending the vertical plane type as a standard.

Committee: JOHN HICKEY, G. W. RHODES, SANFORD KEELER, R. H. BLACKALL, M. N. FORNEY.

No. 7. *Examination of Locomotive Engineers and Firemen.*

On their duties relating to the use of fuel, care of the locomotive and ability to deal with disorder or disability of machinery; to what extent practiced, and best plan for conducting the examination.

Committee: W. H. THOMAS, JOHN PLAYER, F. D. CASANAVE, J. W. LUTTRELL, L. R. POMEROY.

No. 8. *Operating Locomotives with Different Crews.*

Investigate the comparative advantages of operating locomotives with different crews on the "first in and first out" plan, and that of confining men to certain engines, the latter not running a greater number of miles than can be rendered by their regular crews; discuss any improvement in the method of running engines.

Committee: ROSS KELLS, W. W. REYNOLDS, W. F. TURREFF, C. G. TURNER, JOHN A. HILL.

No. 9. *Locomotive for Heavy Passenger and Fast Freight Train Service.*

Investigate the types best suited for this service, and the relative economy and safety of eight-wheel, ten-wheel and mogul locomotives for the service in question.

Committee: PULASKI LEEDS, JAMES MEEHAN, E. M. ROBERTS, C. E. SMART, W. A. SMITH.

No. 10. *Electrical Appliances for Railroad Use.*

Report on the progress of electricity into motive power, car lighting, signaling, welding and kindred uses.

Committee: T. W. GENTRY, G. B. HAZELHURST, ALBERT GRIGGS, JOHN ORTTON, F. W. DEAN.

No. 11. *Standards of the Association.*

Committee: WM. SWANSTON, WM. GARSTANG, C. H. CORY, J. S. MCCRUM, THOMAS SHAW.

Obituary: H. N. Burford.

Committee: J. W. ADDIS, R. H. BRIGGS, J. C. RAMSEY.

Obituary: S. M. Sanborn.

Committee: G. W. STEVENS, W. L. GILMORE, J. S. GRAHAM.

Obituary: H. M. Britton.

Committee: G. H. HAZELTON, N. E. CHAPMAN, REUBEN WELLS.

Disposal of Boston Fund.

Committee: J. N. LAUDER, J. N. BARR, ANGUS SINCLAIR.

To Confer with Committee of Master Car Builders' Association on Bringing Conventions Closer Together.

Committee: O. STEWART, CHARLES GRAHAM, DAVID CLARK, G. W. STEVENS, JOHN MACKENZIE.

On Subjects for Investigation and Discussion.

Committee: WILLIAM H. LEWIS, JOHN WILSON, PETER H. PECK.

Executive Committee and Trustees of Boston Fund and Printing Fund.

JOHN MACKENZIE, JOHN HICKEY, WILLIAM GARSTANG, O. STEWART, ANGUS SINCLAIR.

Custodian of Boston Fund.

J. H. SETCHEL.

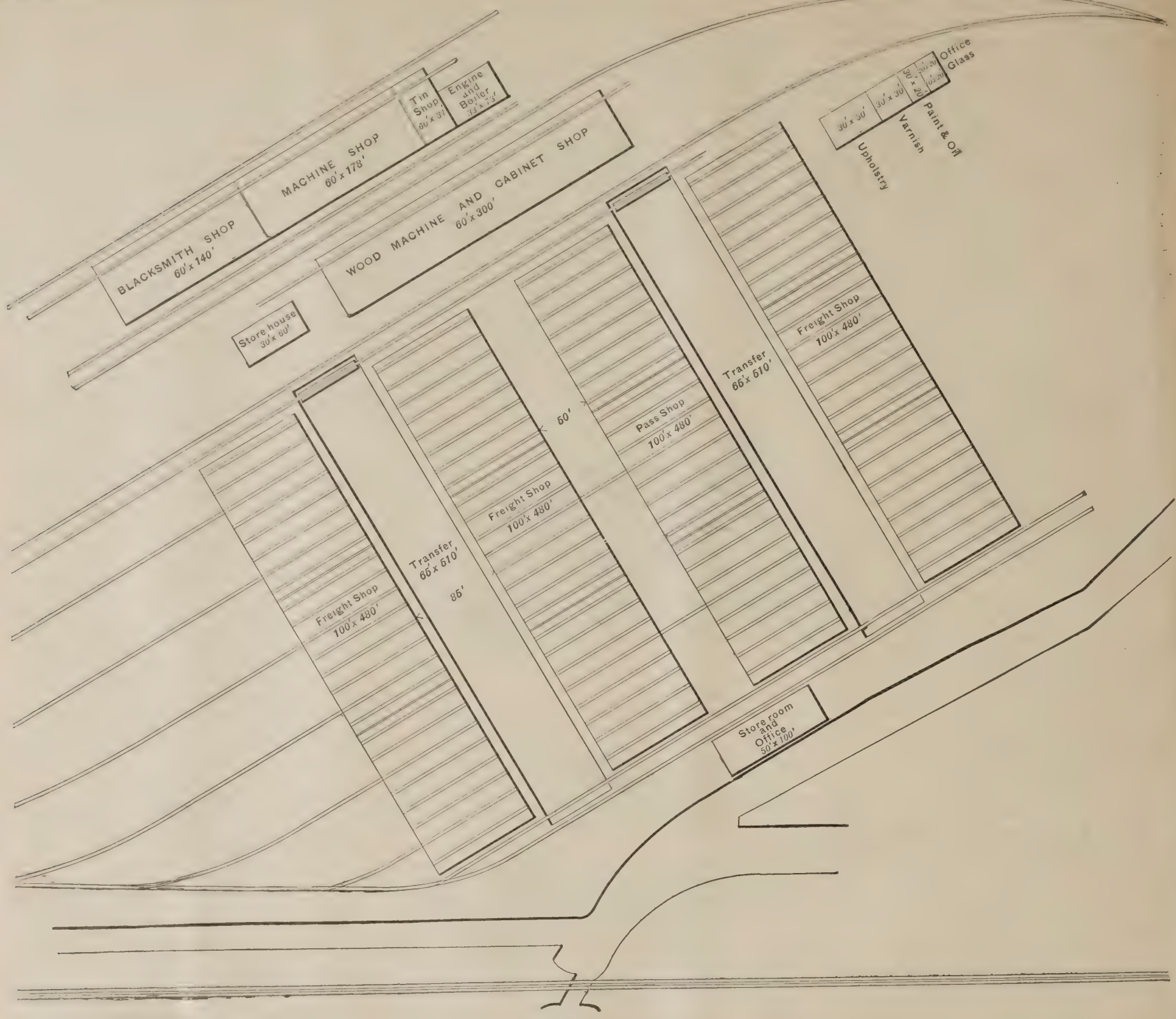
The following resolution was unanimously adopted at the last convention:

"*Resolved*, That the chairmen of committees be required to send in their reports to the Secretary not later than May 1, and that the Secretary be instructed to have reports printed and sent to members in time to be read before the convention meets."

Chairmen of committees are requested to note the above resolution. For the Executive Committee,

ANGUS SINCLAIR, *Secretary.*

The New York, Lake Erie & Western Railroad Company have lately distributed the second thousand of Sinclair's pamphlet on Combustion in Locomotive Fire-boxes among their engineers and firemen.



FITCHBURG CAR SHOPS.

A run of 80 minutes over the Fitchburg Railroad takes us over the space of 50 miles that separates Boston from Fitchburg, a prettily situated, bustling town, specially interesting to railroad men as being the location of the fine car shops of the Fitchburg Railroad. Apart from the interest in the car shops or in various other manufacturing attractions of Fitchburg, the trip over the road is well worthy of the time devoted to it, for it takes the traveler through a most delightful country, that is as rich in historical associations as any district to be found in the United States. Among the places passed are Cambridge, Waltham, Concord and others of smaller interest, while the route takes us through some of the scenes made famous by the stirring events of revolutionary times.

These outside allurements are not necessary as inducement to attract the intelligent railroad man to Fitchburg, for should he be interested in rolling stock matters he will find and enjoy much pleasure in examining the fine new car shops that have lately been finished under the supervision of Mr. J. W. Marden, superintendent car department of the road. The general plan of the shops will be readily understood from the annexed engraving. They are situated on a fine level piece of ground near the main track and are approached on both ends by tracks that branch out from main stems and reach into every part of the establishment where cars have to be placed or material conveyed to. An inspection of the shop plan will show that the principal buildings are arranged on what has been known as the parallel plan served by transfer tables and flanked by the preparing shop.

This general plan of shops commended itself to car and locomotive officers as soon as the best methods for executing repairs systematically became properly considered, as being the most convenient arrangement that could be devised, and a great many of the most imposing railroad shops in the country are arranged in this way. But it was found in many districts that the transfer tables, which are a necessary part of the arrangement, were troublesome to operate, especially in winter, when bearings are stiff and the track frequently obstructed with snow. Power transmitted to the transfer table by means of steam or cable traction was troublesome to keep in order, and, as a means of escaping this source of inconvenience and delay, what was known as the radial plan of shop arrangement attained some popularity. The leading merit claimed for this plan was its dispensing with the use of transfer tables. On the other hand, it interfered with the compact grouping of buildings, and entailed serious disadvantages in the handling of material. The application of electricity as a means of operating transfer tables appears to have overcome all the objections to the parallel plan and to have increased the convenience of serving shops by means of these tables.

The transfer table at the Fitchburg car shops is operated by a Westinghouse electric motor, to which a current is conveyed by means of overhead wires. The efficiency of the motor for this purpose is spoken of in the very highest terms by Mr. Marden and his assistants. Three men do all the work connected with the transfer table, and they not only move the cars and material into and out of the shop, but, by means of a long rope connecting with an electrically-operated windlass on the table and connecting pulleys, they take cars from any part of a long supply track.

The shops are all one story high except the wood machine shop, which has the cabinet shop up stairs. All the shops are dry, airy and well lighted. They are heated by the overhead steam pipe system, which is reported to work satisfactorily, and an excellent distribution of electric lights is provided for night work. The main shops are divided into three sections by brick walls, and each section is supposed to be fireproof.

The location and internal arrangements of the preparing shops are particularly good. As will be seen by the drawing, they are all conveniently reached by car tracks. What is not shown, however, is the happy arrangement of tools and the facilities for moving work and material forward to receive the manipulation that makes it ready for putting on to the car. The tools are the best that were in the market and Mr. Marden examined the best shops in search of ideas as to the best method of locating the tools and added not a few of his own suggested by long experience in the business.

In the planing mill the tools are arranged to keep the material moving forward with the least possible delay, and the original plan of the shop is such as to promote the facile movement of the lumber under manipulation. The lumber passes in from the yard, and heavy pieces, such as car sills first come to a special design of planing machine which planes the four sides of a stick at once and makes an excellent job. There is an attachment to this planer which trims off any taper projections of the timber which might be too great to take off with the ordinary cutting knives, and would cause the stick to be taken to a trimming saw. This planer is not only a particularly comprehensive machine, but it is so operated that its whole capacity can be utilized, being so strongly belted that there is no slip in making the heaviest cut. In ordinary working it planes the four sides of a 36-foot sill in 90 seconds. After it passes the planer there is accommodation provided for storing a limited quantity of the timber, or it may be advanced to the cutting-off machine and thence by easy transition to the tenoning machine. These operations go on in a direct line, then the piece is passed across a track to the mortising and boring machine, where the job is finished. This is the heavy work of the shop and it is all confined to one side. On the other side of the shop the smaller machines are arranged in the best possible order for getting out all varieties of work by systematic methods. Among the smaller tools which appeared worthy of special mention was a Rogers gaining machine. This tool was being used for turning out a great variety of work that required exact reproduction. When the tool was once set for an operation recurring reproduction went on till a change was made. The tool appears to be as convenient for a planing mill as a turret lathe is in a machine shop.

A hydraulic elevator capable of taking on and raising a truck load of stuff is the means of communication between the planing mill and the cabinet shop upstairs. The latter shop is well provided with all the facilities required in a first-class shop of the kind.

The machine shop and blacksmith shop are both unusually well provided for the special work required in car building. In the latter shop they have a very powerful combined punch and shear machine, which is used very successfully in doing forming work with dies and matrices made to suit. A great variety of forming operations called for in the iron work of trucks is done very successfully and economically on this tool. It is wonderful the work that can be got out of a blacksmith shop by the aid of machinery when there is a foreman of a mechanical turn in charge. That is just as surprising as the paucity of work turned out by the best facilities when a foreman is in charge whose mind never rises beyond the complexity of a wheelbarrow.

Attached to the wheel press in the machine shop they have a disc on which a graphical register of the pressure used in putting on all wheels is atomatically recorded. The record paper is removed daily and made a permanent record of the work. This acts as a check upon reckless practices in pressing on wheels, and provides a means of showing at what pressure the wheel was put on the axle, should it get loose or break. We believe that a register of this kind would be the means of greatly reducing the annoyance from loose wheels and broken hubs. The device can be worked at trifling expense, and we think it is worthy of general adoption. The register is locked out of the control of the workmen, which puts their performance in wheel setting constantly under supervision.

Another special appliance worthy of general introduction, which we found in use here, was a means for proving if car journals are cylindrical and true with the turning center. A pair of wheels are set in a lathe on their axle centers. A stand is made as an attachment to a Bement & Miles lathe that will rest on the journal and remain upright. Through the center of this stand is a tube which holds loosely a straight rod, one end of which rests upon the journal. To the upper end of the rod is connected a fulcrumed pointer which magnifies some six-fold the movement of the rod. When the journal is moved round in the lathe the rod, whose end is resting on the surface of the journal, will move up and down if the journal is not perfectly concentric with the center. The amount of distortion is readily reckoned by the movement of the lever.

They have a very good fire department in connection with these works. An experimental alarm was given while we were there and men rushed from all quarters to their posts in a way that indicate careful drilling. A stream of water was spouting over one of the shops within thirty seconds after the alarm was given. Mr. Marden besides having finely arranged shops is aided in his work by highly efficient foremen. There is no small share of credit due to the officer who has the faculty of selecting capable assistants. The visit to the shops was made all the more interesting by the company of Mr. O. Stewart, superintendent of motive power at Boston, and of Mr. Leach, master mechanic at Fitchburg

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The Georgia Southern & Florida Railroad Company, of which mention was made in connection with appointment of Mr. G. D. Harris, runs from Macon to Jacksonville, and a line from Macon west to Birmingham is about completed. It is, without doubt, one of the most promising enterprises of that or perhaps any other section. No road that we know of has been so thoroughly built and equipped thus far, steel rails being 76 pounds to the yard; joints all laid with 54 inch angles resting upon four ties; bridges are iron; culverts of stone. Passenger equipment is the most modern. It is aptly termed the "Gilt-edge." Its stock sold in the open market at Macon at a premium—none now to be had. An acquaintance with the management, from President Sparks down, reveals a long-headed and capable organization. This is known as the "Suwanee River Route," passing through, as it does, that place, and running alongside of the river bearing this name, made familiar by song.

Fitchburg Railroad Shops.

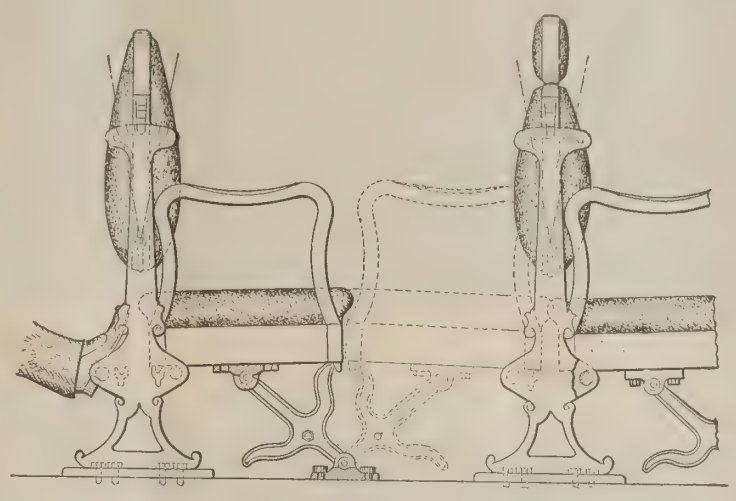
The Fitchburg Railroad Company are carrying out important improvements at Boston on their shops for the repairing and housing of locomotives, and Mr. O. Stewart, the master mechanic, anticipates soon having conveniences for doing work that will be nearly equal to the needs of the road. About a mile from the repair shops the nearest point where the required room could be found, they are putting up a 40-stall roundhouse that will be equal in accommodation to anything in the country. The pit-bases, turn-table supports and foundation walls are of massive granite masonry, sufficiently ponderous to carry a cathedral. Those who have designed this house have taken care to provide a good margin for the increase in size of locomotives. The turntable is 60 feet across and the stalls of the round house are 80 feet long between walls. Everything is done in first class shape. All the most approved conveniences will be provided for housing locomotives and for cleaning and doing running repairs.

The roundhouse that is now in use, and which is close to the machine shop will be remodeled and converted into an erecting shop. This company had lots of locomotives that had boilers which were too small to supply the cylinders freely with steam and consequently they were operated at high cost for fuel. Mr. Stewart has been gradually providing these engines with larger boilers and they make highly economical machines for light work.

An Improvement in Car Seats.

The ordinary reversible back seat has had a pretty long run on American roads because of its reversible adjustment, but it has a number of disadvantages that are well known. In the first place the back has to be light and strong, is limited as to height, and being hinged to the seat ends, it cannot be taken out for cleaning. Seats are reversed in order to throw two together either for parties or for the baggage or feet of hoggish travelers. On the western trunk lines running through cars over 1,000 to 2,500 miles of road, there is a great temptation to make beds of seats by removing and changing seat cushions

The invention here illustrated, for the cut and description of which we are indebted to the *Locomotive Engineer*, consists of stationary standard supporting fixed backs, while the seat itself is reversed by swinging it on its support, and using the opposite back, as plainly shown in the drawing.



The backs are double, and upholstered on each side, and can carry a head-rest such as used in reclining chair cars; the back can be inclined either way by the use of notches shown in the standard, and can be lifted out of its place to be beaten and cleaned.

The swinging seat is held at the center and front by its supporting link, and at the back by the foot rest.

This arrangement secures to each passenger a degree of privacy not possible with the reversible back seat, as it admits of his riding with his face to the front or rear without facing his neighbors. It provides a better headrest and less draughts. It effectually prevents the putting of feet on opposite cushions, and makes a seat in which both the back and seat cushions are removable for cleaning.

This seat has just been patented by Geo. W. Cushing, Chicago, Ill.

Moving Trains by the Staff System.

Through the courtesy of Mr. Lucius Tuttle, General Manager of the New York, New Haven & Hartford Railroad, the writer was recently accorded the privilege of watching the working of the "staff system," which has been adopted for the operating of trains on a piece of single track between New London and Lyme, a distance of seven miles. The American method of operating single tracks is based on a time table, rules and train orders, with an officer, called a train dispatcher, standing like a general with all the trains under his eye, and by means of the telegraph, controlling the movement of all the trains on each division. With an able train dispatcher, intelligent trainmen, well informed on train rules and rights, and plenty of siding accommodation, an immense train service can be safely and expeditiously operated on a single line of track. Personal care, vigilance and attention are, however, essential requisites in the safe operating of a single track. The rarity of head collisions in our vast network of single track railroads is certain testimony that American trainmen supply the personal attributes necessary for successfully working single tracks on the American system. The "staff system" is the English method of operating single track lines, and it aims to dispense with intelligent personality and substitute mechanical contrivances to secure the safe operating of the trains. This distinguishing difference in methods is not confined to the operating of single tracks. It is to be noted as permeating the spirit of railroad management in the two countries. In Great Britain the personal equation is reduced to the lowest possible importance as an element in train operating and the mechanical equation magnified; in America mechanical appliances for promoting safety have always been regarded as secondary to personal care and intelligence. President Adams, of the Union Pacific, testifies to this in one of his books where he says: "In discussing and comparing the appliances used in the practical operating of railroads in different countries, there is one element which can never be left out of account. The intelligence, quickness of perception and capacity for taking care of themselves—that combination of qualities which, taken together, constitute individuality and adaptability to circumstances—vary greatly among the railroad employés of different countries. The American locomotive engineer is especially gifted in this way. He can be relied on to take care of himself and his train under circumstances which in other countries would be thought to insure disaster." Although Mr. Adams omitted to mention conductors and telegraph operators in the work of moving trains safely, they are entitled to a fair share of the credit given to engineers.

The staff system which we found in operation on the New Haven road was different only in minor details from the system the writer worked under in Scotland many years ago. The plan of railroad construction followed in Great Britain did not encourage the building of single lines of track, and there are very few of them in operation. The traffic on all lines there is fairly uniform, and no great difficulty was experienced in operating the trains on regular schedules with the meeting points established. The necessity for special provision for operating the trains on a single track safely arose through cases of accident where one line of the double track was blocked for hours. Trainmen accustomed to double tracks do not readily learn the rules for operating a single track safely, and it frequently happened collisions occurred where the single track had to be operated for a short period. There is no train dispatcher exerting authority over the movement of all trains, each station-master having the right to move trains from his own station. This divided authority tended to breed confusion when a section between two stations had to be operated by single track, and conflicting authority led to accidents. Various expedients were resorted to as a means of operating safely. A common practice was to have one man with a red cap to ride on the engine of every train that passed over the single track. Another plan was to provide a pilot engine that accompanied every train, but the plan of using a staff became most popular, and finally received the sanction of the Board of Trade, which exercises government supervision over British railways.

The staff system as first used called for the staff alone, and an engineer was forbidden to run over a single track without having the staff in his possession. A train going

from *A* to *D* had to stop at *B*, where the single track begins, and take up the staff, which was carried on the single track section from *B* to *C* and left at *C*. A train could not go in the opposite direction if the staff happened to be at *B*, until some train came along and brought it over the section. When two or more trains followed each other without any from the opposite direction intervening, delays occurred at the staff station. To remedy this the ticket system was added. When the staff operator, say at *B*, is aware that several trains are following each other and will have time to pass over the single line section before a return train wants to pass, he gives the engineers of all the trains except the last one tickets which convey authority to the holder to pass over the single track. But a ticket can only be given from the point where the staff is, and the staff is used as a lock for the box that contains the tickets. When the staff operator at *B* knows that a train will next be due from the opposite direction, he sends the staff over to *C*, and the operator at that point can then send over as many trains as he chooses, while he retains the staff. On the leading single track lines in Britain the staff system is so operated that an engineer can receive staff or tickets without reducing speed. On the section in use on the New Haven road all trains have to slow up to receive authority for passing.

The system works very well where trains are run regularly, but it is not at all adapted to the conditions found on most American railways. Trains on American railroads are frequently so heavy in relation to the power moving them, that it is hard to calculate when they will arrive at a station. The staff man at *B*, which we may call NewLon don, has been informed that a train will reach *C*, which represents Lyme, at a certain time on its way toward *A*, and he send over the staff. Meanwhile an unexpected delay has happened to the train at *D* or at some other place short of *C*. The staff is at *C* and while it remains there an important train arrives at *B* and is delayed until the delayed train from the opposite direction arrives with the staff. This is in fact a situation which has several times happened on the New Haven road and the company's officers have already got into the habit of issuing orders to suspend the working of the staff system for a certain time to permit trains to be moved by telegraph. Where delays to trains are of little consequence, or where the number of trains to be moved daily is fairly uniform, the staff system is all right; but we do not think it is destined to find a place in our system of train operating. If the staff and ticket system is rigidly adhered to, it leaves the smallest possible opening for accidents; but its use is certain to curtail the expeditious movement of trains. If for the sake of getting trains moved, the practice of suspending the staff system is frequently resorted to, it would be decidedly more dangerous than the system of train orders. On the whole we think it would be cheaper in the end to double track a line than to introduce the staff system.

Recent Boiler Explosions.

Locomotive boiler explosions have been more common during the last six months than they have ever been within the memory of the present generation, and more numerous probably than they have ever been before. The tendency toward higher pressures is bearing fruit, and the lesson of the numerous boiler explosions ought to be taken to heart, for it teaches that increase of pressure is safe only when the boiler is built with a sufficient margin of safety over the pressure to be carried. Boilers ought to be constructed so that they will be safe to use when the strength has become impaired through age and hard usage. Reducing the tension on the safety valve is a practice that our master mechanics resort to very reluctantly, but they ought to choose the safe side and sacrifice economical working if they are not ready to send a boiler to the scrap heap. There are, unfortunately, too many boilers in service that ought to be in the scrap heap.

The annexed engravings are interesting pictures of a recent boiler explosion that was extraordinary from the fact that no loss of life resulted from it, although the engine was running when the explosion happened, In the case where the outer shell of the fire-box gave way. the rupture followed the line of the seam and the force of the explosion turned the engine on its side. Fig. 2 is another view of the same engine. This accident originated from a cause that is likely to bring other boilers to destruction if they are not closely watched or, what is better, strengthened in time. The builder of the boiler constructed the outside shell of this and many other fire-boxes with a lap longitudinal seam on each side about half way between the dome and the top of the fire-box. A row of sling stays was placed in line with the dome opening and cross tie rods were placed from side to side of the fire-box just above the crown sheet. This arrangement put the longitudinal seam in the middle between two rigid points. The pressure of steam inside the boiler forced the shell outward and the weak point close to the seam became the joint of movement. After many days this movement cracked the sheet and it broke open with the results shown. We have heard men in charge of locomotive boilers express doubts about boilers changing form when steam pressure was on. If any such men have charge of boilers similar to this one we would earnestly urge them to strip the boiler and attach to the outside of the shell a lever that will multiply movement, then raise steam.

Fig. 1.

Fig. 2.

One of our friends, who is full of sympathy for the Knights of Labor and all organizations of that ilk, was nearly prostrated with indignation lately on noticing the heading that a new automatic stock-waterer had been invented. Railroad stock was running constantly in his mind, and he was very much disgusted on learning that a tirade of abuse had been wasted on an invention for watering cattle, sheep, pigs and horses.

Master Car and Locomotive Painters' Convention.

The twenty-first annual convention of the Master Car and Locomotive Painters' Association was held at Boston, Sept. 10, 11 and 12.

The principal business consisted of the reading of reports and discussions on the following questions: Is it a benefit or a detriment to an undercoat of paint to have an egg shell gloss? Should hard and soft woods be primed alike to make a good and lasting job of painting? What is the best one coat of paint that will hold rust back the longest? Which color will show us the best on a locomotive and tank after eight or ten months of service, ivory black, lamp black, or Brunswick green? What is the best and quickest method of removing old cracked and scaly paint from driving wheels, domes, and other rough castings? What is the best way to test the quality of japan before mixing into paint?

Secretary McKeon read the following regarding the last question: "Test 1. Mix a portion of the japan on trial with linseed oil. If it curdles the oil, mark it down as poor stuff. Test 2. Mix the japan with oil paint in usual proportions to make the paint dry well, and coat up a piece of work which has been primed (at least). If the paint dries tacky, pronounce the japan bad. Test 3. Grind drop black (stiff) in japan; thin with turps to the usual consistency for working, and spread on a coat. If, after standing twelve hours in a warm shop it warps up, set it down as deficient in binding properties. Test 4. Spread a coat of the same evenly upon a clean glass; let the coat dry 48 hours, and look through it at the strong sunlight or at a single lamp burning in a dark room (the latter is the best). If you find the paint full of fine cracks use no more of that japan. The last is a severe test, but first-class japan will pass under it. For quick drying properties test with lamp black ground in raw oil; if it dries this it will dry almost anything else.

The following officers were then elected for the ensuing year: President, Joseph E. Murphy (Louisville & Nashville); first vice-president, E. L. Fetting (N. Y. & N. E.); second vice-president, A. S. Coleman (Intercolonial); secretary and treasurer, Robert McKeon (N. Y. & P.), Kent, O., (re-elected.

We shall give particulars of the discussion in future issues when we can spare the space for them.

A mahogany tree lately cut in Honduras made three logs which were sold in Europe, says an exchange, and brought over $11,000. The mahogany tree ranges from one to seven feet in diameter, is often 60 feet to the first branches, and frequently exceeds 90 feet in height. The Honduras mahogany comes to market in logs from two to four feet square and 12 to 14 feet long, planks sometimes being obtained that are seven feet wide. The weight of a cubic foot of mahogany varies from 35 to 53 pounds. As compared with oak, which is called 100 per cent., the strength of mahogany is 67 and 96, its stiffness is from 73 to 93, and its toughness from 61 to 99 per cent. The government engineer of Honduras estimates the total value of the trees, such as are regarded fit to be cut, at $200,000,000, while the smaller trees not ready to cut are also worth a large amount.

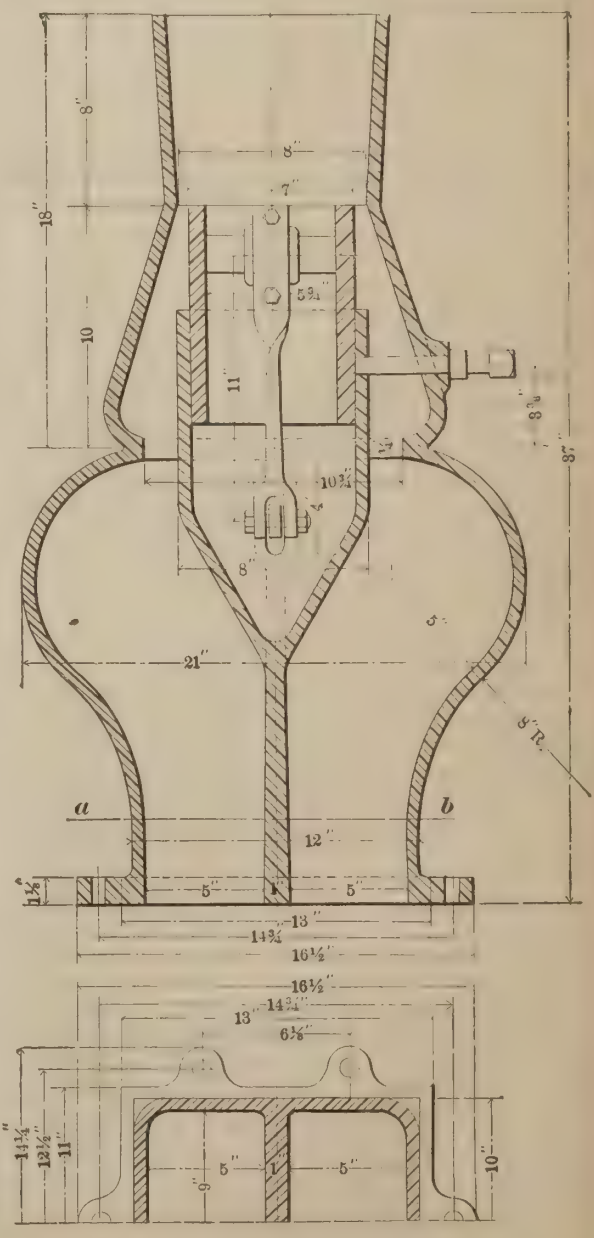
There was a very interesting and edifying meeting of the Central Railway Club at Buffalo, on Sept. 25, President Chamberlain in the chair. A peculiarity of this club is that the discussions are conducted in the form of conversations. This club is noted for the number of general foremen and chief joint car inspectors who attend, men who can always give valuable information on the practical matters relating to car repairs, car disorders and car interchange. Some of them, while possessed of the facts that others are anxious to obtain, have not the training necessary to express themselves in a continuous speech, but they can take a ready part in colloquial discourse. So it has become the custom to sit and talk about the subjects under consideration, and the meeting is never oppressed with silence. At the last meeting there was a great deal of talk about the practice of some companies of pass-carding cars. It appears to be a practice for some master car builders to use pass cards for sending cars away from home that are not safe to run, or at least are not safe after the defects get a little worse than they were when the cars started on a long journey.

The practice often inflicts injustice on other roads, for the defects lead to failures of other parts that the connecting roads receiving the cars have to stand responsible for.

Mr. James Macbeth, of the West Shore, read a very carefully prepared paper on counterbalancing of reciprocating parts of locomotives. He took a highly practical view of the subject, and had evidently collected particulars of the distribution of weight that produced the best results in making locomotives run smoothly. Considerable discussion followed the reading of the paper. The meeting was very well attended.

An Expanding Nozzle.

An exhaust pipe, designed in combination with an expanding nozzle of the form illustrated in the annexed engraving, is in use on the Atchison, Topeka & Santa Fe. A form of nozzle that could be expanded when an engine was pulling hard and was making more steam than the cylinders called for would be a valuable means of saving fuel. It would also enable a size of nozzle to be used that would be adapted to burn to advantage the various qualities of coal supplied. The difficulty with expanding nozzles generally has been that they become distorted by use in a trying situation and then they fail to work satisfactorily. In the invention shown a cylindrical guide is provided for a plug which can be raised or lowered to change the extent of steam opening. In the engraving the movable plug is shown as secured by a set screw, but the intention is to arrange the connections so that the regulating plug can be operated from the cab.



Joint Car Inspection.

During last season the Central Railroad Club devoted particular attention to the investigation of the difficulties encountered in the expeditious interchange of cars, and a committee consisting of master car builders and car inspectors submitted a very good report on the subject. The committee was composed of A. M. Waite, Peter Smith, Thomas Sutherland and J. K. Petrie. The conclusions and recommendations of the report are as follows:

It is found in the actual working of straight inspection that there is a constant and daily delay of cars and freight, due to the difference of opinion of the inspectors of the connecting roads. Tne cars are cut out of trains and set back and sometimes are then carded and sent along again; other times, rather than card a car the freight is transferred at an expense of from one to four dollars. When we consider that each 20-ton car, when business is good, is worth from three to four dollars a day to the road, the holding or setting out of cars, on account of disputes between inspectors, becomes an expensive and serious matter. It is found where there is a straight inspection that there many times arises a jealousy or feeling of retaliation between the inspectors which makes them cut out or transfer cars frequently, which ought not to be so treated. There is often a different interpretation put on the rules by the inspectors, wh ch causes delays and, consequently, expenses. When disputes arise between inspectors at straight inspection points, the heads of car departments are obliged to take the matters up for settlement, causing much loss of time and annoyance, and in most cases, ending in discovering that the disputes and delays arose from over-smartness of one inspector in getting even with another. There is, perhaps, no question, but that straight inspection is the most rigid of anv, but rigid inspection which goes beyond the limits of assuring cars to be in safe running condition, and a just fixing of responsibility for defects, is too rigid and uncalled for, but straight inspection is frequently carried beyond these limits. It must be acknowledged that straight inspection causes many delays to freight.

It does not avoid disputes.

It does not avoid unnecessarv transfer of freight.

It does not avoid cutting out cars from trains and setting back to delivering roads, and, as these facts are true, it does not give economical service, as delays to freight, lying idle of cars, and cost of unnecessary switching would in most yards pay the wages of 50 per cent. more men in favor of any other system of inspection.

The system of joint inspection, as used at Buffalo, will give the following results:

Almost all unnecessary delay to freight is avoided.

The cars are assured of being in safe condition, according as the men are efficient, and are well looked after by the joint car inspector.

A more just placing of responsibility for defects can be made by one unprejudiced man of good ability than from the contrary arguments of two men each prejudiced in favor of his own road.

All disputes are avoided at interchange points, as the joint inspector has no one but himself to dispute with.

There is a smaller percentage of transfer of freight under a joint inspector, as all disputes and differences of opinion as to carding defects are done away with, and only absolutely necessary transfers need be made.

Cars are not cut out and set back to delivering roads where there is a joint inspection, as the fundamental principle of joint inspection forbids that, the joint inspector placing the final responsibility for repairs where it belongs.

In economy of service, there are no doubt many points where the same number of inspectors are required to do the work with joint, as with straight inspection, but no more men are needed, and in many cases the force is reduced. But the principal economy comes from avoidance of delays to freight and to cars, and saving of an immense amount of switching.

The same answers must be made to the requirements in the system of inspection used at Toledo, Detroit, and East St Louis. In view of these facts, no other conclusion can be arrived at but that the joint inspection is the best in matters of economy, of expenditure, protection for companies and despatch to freight in transit.

It may be well to consider the comparative points of merit and disadvantage of the two main systems of joint inspections.

There is undoubtedly in the minds of all a decided advantage in so organizing business matters that there is a check on all transactions, so that if errors occur they may be corrected. It must be said with regard to the Buffalo system of inspection that there is no check on the inefficiency or carelessness of the individual inspectors until the errors are discovered long after the acceptance of the cars at some other inspection point on the receiving road. Any matter then brought up may be at once laid to cars being damaged after inspection, in case the defect is not on record at the joint inspection point. This lack of a check on errors or carelessness becomes a source of much trouble on our various roads in delivering cars which have passed the joint inspection to other connecting lines. There is in the Buffalo system only one remedy for this, namely, for each road to have a set of inspectors to look over the cars again after they are delivered to them.

In the Detroit and Toledo system, this difficulty is looked after, and a complete check is provided, as each car is twice inspected, once before and once after delivery, and if there is any oversight or carelessness in the first inspection, it will be shown up by the final inspection on the receiving road. Joint inspection is not a cure for all the annoyances in the interchange of cars, but it can do much toward reducing them to a minimum.

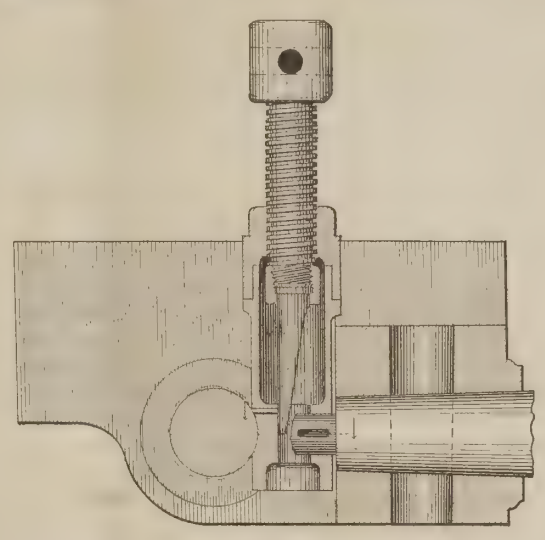
Your committee would recommend for adoption, as the sense of this club, the following resolutions:

Resolved, That the best results in the interchange of freight cars between different roads, as regards economy, dispatch to freight, and protection to the roads, can be obtained from a system of joint inspection.

Resolved, That a system of joint inspection, where the cars are inspected both before and after delivery, and where each company employs its own inspectors, and the joint inspector acts as an arbitrator, with authority to finally settle all disputes, and to control the inspectors in all matters of inspection, is the system best calculated to reduce the troubles at inspection points to a minimum.

Cross-head Jack.

Annexed engraving shows a very simple and highly efficient form of cross-head jack invented and patented by Mr. S. A. Teal, master mechanic of the Fremont, Elkhorn & Missouri Valley Railway, at Missouri Valley, Ia. The engraving makes the style of the invention so plain that no description is necessary. Cross-heads are often fractured by the pounding they receive under crude methods of removing them, and an invention calculated to prevent this source of expense, delay and danger is certain to be of value. There is no doubt that the use of the jack shown will prevent the accidents that send pistons through cylinder heads.



Since the above was written, we have received from the inventor the following particulars about the jack: This jack is designed for the purpose of removing the cross-head from piston rod in locomotives or other engines.

Referring to the small blue print. The jack body is a casting in two parts, made of steel and screwed together as shown. The screw made of steel and hardened at its lower end, where it is connected by means of a swivel nut to a steel wedge. This wedge is a round piece of steel milled flat on one side as shown, and is also hardened. The flat or tapered side of the wedge is brought in contact with the ram.

The ram is a round piece of steel fitted into a hole made in jack body, so that when the wedge is forced inward or down the ram is forced outward; so that if the outer face of ram is brought in contact with the end of piston rod and the jack body is in contact with cross-head pin, the wedge, having a bearing against a portion of jack body at the piston rod, is at once easily forced out or from its seat.

This is a very convenient little tool. Simple and compact. It does away with wedges, sledge and other awkward contrivances. Also there is very little, if any, danger of breaking cross-head and no damage to guides.

We have taken off some very tight cross-heads with this jack, and in one or two instances we found that after a very heavy strain was put on the jack a smart blow with a soft hammer on the rod made the cross-head let go at once.

The Philadelphia & Reading Disaster.

On Sept. 19 an express train on the Philadelphia & Reading struck an obstruction near Shoemakersville and the engine and five cars were thrown into the Schuylkill River, killing or drowning 21 persons and injuring many others. The accident was caused by a rear collision of coal trains on the southbound track, some of the cars being thrown over in front of the express train and the latter coming upon them before there was time to send out a danger signal.

A coal train of 150 cars broke in two about 100 cars back of the engine. Another coal train of the same length, following about 10 minutes behind, ran into the rear of the first before it could be got under way again. The caboose and one or two cars were derailed, and part of the wreck was thrown over upon the passenger track. The evidence is not clear as to how much time the flagman of the first coal train had to get back with his flag, and as to how far he actually went back. It is probable that he had about ten minutes to go back, and that he went about 200 yards. The view from the first train was shortened by a cut and a curve, and the grade was descending, consequently it was impossible to stop the train after the flag was seen. The express train reached the wreck almost simultaneously with the collision with the freight train. The coroner's jury censured the flagman of the first train for not getting out and putting down torpedoes while the train was losing time. It was his duty under the rules to do this when a train was not running more than three miles an hour. The trains passed Perry, two miles from where the accident occurred, 12 minutes apart.

From the testimony of the runner of the first train it appears that he struck a torpedo several hundred yards north of where the accident happened and had slowed down and "drifted" past the Shoemakersville station, but he put on steam again just before the break-in-two. He was running about 10 miles an hour when he passed Perry, two miles north of Shoemakersville. He thought that the express train was running from 50 to 55 miles an hour when it passed him.

The engineer of the second coal train testified that the signal was seen about 500 yards before the rear of the first train was struck. He applied the driver brakes, but could not stop. He was running 10 to 20 (others say 10 to 12) miles an hour and could have stopped in 1,200 yards. The flagman could have got back to where he was seen in three minutes.

Leather Brake Shoes.

"There's nothing like leather," was the exclamation that escaped us when vesterday afternoon we assisted at an exhibition of Arnold's Patent Compressed Leather Company, held at the offices of Messrs. Inglis, Robson & Co. Among those present were many members of the Sydney and provincial press, also representatives of big city firms and capitalists, who all expressed the greatest surprise at Mr. Arnold's wonderful productions. Some years ago the tremendous waste of leather scraps, thousands of tons annually, struck Mr. Arnold very forcibly, and set him thinking. He ultimately hit on the idea of turning them to profitable account by steeping in a certain solution, and subjecting the mass to hydraulic pressure. Like many another inventor his ideas were beyond his means, until the Hon. R. H. D. White came to his assistance and helped him over. The result is, to-day leather scraps can be made up into a thousand and one articles, the indestructibility of which is amazing. One specialty in particular for which this compressed leather lends itself is railway brake blocks. From a report by Mr. D. H. Neale, the Government engineer, who at the chief commissioner's request has made some very exhaustive tests of this leather versus iron brakes, we learn that, while iron brakes weigh 21¼ pounds, the leather shoes only weigh four and a half pounds; yet the life of the leather brake is nearly three times that of iron, 40-pound pressure on the break-pipe being sufficient, as against 70-pound for iron. But herein lies the tremendous advantage of leather blocks. Thousands of pounds of rolling stock have annually to be dispensed with through the destructive effect of iron brakes. They destroy the tires, and play sad havoc. With leather it is just the contrary. It is therefore only a matter of a short space of time when compressed leather must be used all over the world for railway brakes in preference to every other material. The present company is offering 2,000 shares to the public, with a view to erecting extensive works at Marrickville, which will not only turn out ten times more material than at present is possible, but a far superior article. Mr. Arnold has patented his invention in Great Britain, United States, France and other countries.—*New South Wales paper.*

M. C B. Standard Coupler.

Mr. E. W. Grieves, master car-builder of the Baltimore & Ohio, sends us the following information respecting the work of a committee of which he is a member:

At the last convention of the Master Car Builders' Association it was suggested that a special committee be appointed to ascertain if the various automatic couplers of the M. C. B. type, being manufactured and sold, conform to the standards of the association, and the Executive Committee was instructed to take hold of the subject and investigate it. Accordingly, a sub-committee of the Executive Committee was appointed by the President, consisting of Messrs. E. Chamberlain, J. N. Barr and E. W. Grieves, to carry out the details of the investigation and make their their recommendations as to the use of proposed templets and general instructions in the matter of conformity. This committee has addressed the following letter to the manufacturers of the various couplers:

"The special committee appointed from the M. C. B. Association to ascertain whether the M. C. B. type of coupler now being furnished by the several manufacturers conforms with the standards of the association, and to submit a plan for the guidance of the association in the maintenance of these standards, would respectfully request that manufacturers of this type of coupler forward, on or before Nov. 1, 1890, at their own expense, freight or express charges prepaid, to Buffalo, N. Y., care of E. Chamberlain, Chairman of committee, a sample coupler and drawing, or blue print of same, for examination by the committee. All sample couplers and drawings of same will be returned to owners immediately upon completion of committee's work."

A wear plate for railway ties has been lately invented by Mr. John Churchward, Brooklyn, and assigned to the Dunham Manufacturing Company. The plate has depending flanges that enter the tie, and spikes of a special shape are driven diagonally through the plate into the tie, holding tie, rail and plate firmly bound together.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

OCTOBER, 1890.

Subscription.—$1.00 *a year for the United States and Canada: $1.50 a year to Foreign Countries embraced in Universal Postal Union.*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Increase of Subscription Price.

Beginning with the first of next year, the subscription price of the NATIONAL CAR AND LOCOMOTIVE BUILDER will be two dollars a year. A first-class journal of the size and quality we are publishing cannot be produced and sold for less money than the sum named. Ever since the paper was enlarged the subscription price has fallen short of covering publishing expenses, and we only act on sound business principles in asking that our patrons should pay a fair price for what they purchase. We are engaged in making arrangements for improvements that will enhance the value of the paper, and we are justified in promising that subsubscribers will receive full value for the increase of price.

Reform the Methods of Car Inspection.

The few changes made in the Rules of Interchange of Freight Cars at the last Master Car Builders' Convention, and the small amount of discussion that was raised in the settling of the various rules, indicates that the rules regulating the interchange of cars are nearly as perfect as they can be made. Rules for the guidance of railroad men are very much like general laws—they are highly satisfactory when those concerned are willing to obey them; but they are very liable to be violated when self-interest or natural contumacy inspire the desire to override them. It would be difficult to suggest an amendment to the rules of interchange of cars that would be calculated to promote harmony, or to advance the cause of just dealing; yet, in nearly every district where interchange of cars is largely carried on, there are constant delays to the movement of freight occurring, which arise ostensibly through the power wielded under the rules of interchange. This condition of affairs requires to be reformed, and if the officers responsible for keeping cars in running order do not devise remedies and apply them very soon, the officers above them are likely to take the business into their own hands. Many managers are now very much dissatisfied that disputes about the mechanical condition of cars should cause exasperating delays in the movement of freight.

Methods for facilitating the interchange of cars and the rules relating thereto have been very exhaustively discussed in our columns during the last year, mostly by master car builders and intelligent car inspectors, and the evidence produced is to the effect that the avoidable delays in the interchange of cars are principally caused by personal feeling between the car inspectors of different roads, who satisfy petty animosities by raising obstacles to the prompt transfer of cars. Retaliations follow, and important railroad interests suffer through the weak desire of one man to obtain a trifling advantage over another. The feeling generally originates through mistaken zeal for the interests of the company served, but that does not prevent the result from being injurious to the interests of all concerned in the expeditious movement of freight cars. It is supremely difficult for the heads of car departments to restrain the species small sharp practice which arises from a mistaken sense of duty even when there is a real desire to do so. We confess that we frequently find a disposition among the superiors of car inspectors to obtain advantages over rival companies by means of contemptible methods of sharp practice. Where a spirit of unfairness prevails on the part of one company handling cars at a large interchange point, it has a tendency to corrupt the officials of other roads, for they must benignly and smilingly submit to impositions and injustice or retaliate in kind. That this condition of affairs prevails at many interchange points is an admitted fact. Master car builders cannot change the miserable meanness of human nature that contributes to lay the foundation of disputes regarding car interchange; and it is, therefore, their duty to devise methods which will reduce the causes of conflict to the lowest possible terms.

The most promising scheme to put an end to the delays to car movement, arising from the conflicting practices resulting from divided authority, is the general adoption of a good plan of joint inspection. If all the railroad companies doing business at interchange points cannot agree to confide all their interests to one responsible officer, they have no right to undertake the transportation of freight requiring expeditious movement. The Master Car Builders' Association have appointed a committee to investigate the subject of joint car inspection to report at next meeting. It is to be hoped that the investigations will be thorough and the conclusions decisive. We consider the most important business in sight for the Master Car Builders' Association to undertake is the work of devising and putting into practice any equitable and practicable system of joint car inspection that will not be too expensive to operate. One of our correspondents, an experienced master car builder, who has very ably discussed the merits of the different methods of joint car inspection in use, has intentionally or otherwise prejudiced many in favor of what is known as the Buffalo plan of joint inspection. We do not consider that the plan in question is by any means perfect, but it might easily be made the basis on which to build a satisfactory system.

There are two well-known systems of joint car inspection in use, both of which have merits and shortcomings, and both have strong advocates and vigorous detractors. What is known as the Buffalo plan has been in use to some extent for nine years, and it works so satisfactorily that a great many car builders in the Middle States are decidedly in favor of its extension to all large interchange points. Under this plan the chief car inspector is employed conjointly by all the roads working under the system, and he is amenable to the heads of departments of all the roads interested. All the working car inspectors are under the charge of the chief inspector who exercises a general supervision over all the work done. The cars are all inspected on arrival in the yards, and the repairs made that are considered necessary, and the responsibility for making the repairs decided by the chief inspector. The weak point about this plan is that cars after inspection may be injured in switching before they are delivered to connecting roads, and on account of that be placed in an outward bound train while in a condition unfit for running.

In what is known as the Detroit plan, which is also in use at Toledo, all the railroad companies employ their own inspectors as in the old way and control them through their own car foremen, irrespective of connections; but their is a joint inspector whose duty it is to settle disputes that may arise in the delivery of cars to connecting lines. The leading objection to this plan is that the joint inspector has no authority to promote the prompt delivery of cars, and tiresome delays often happen, caused by the same influences that obstruct the delivery of cars under the independent system. The Detroit plan insures more thorough inspection than the Buffalo plan, but it leaves too many opportunities for contentious inspectors to delay the delivery of cars. If the companies concerned would agree to give the joint inspectors under the Detroit plan direct authority over all the car inspectors a very successful system of car inspection might be established.

There is a mistaken sentiment respecting the chief end of car movement among many inspectors, and nothing but a radical change of methods will eradicate the fallacy. They act on the assumption that cars are brought in from foreign roads for the purpose of giving them opportunities to display the brief authority with which they are invested. Nothing but a fair system of joint inspection will lead to general acquiesence in the principle that cars should be subjected to no avoidable delay, and that the question of safety alone justifies detention. Any plan of reform that may be recommended by the Master Car Builders' Committee is likely to be an improvement upon the present condition of independent inspection, and its adoption is likely to effect an improvement on the existing conditions that are attracting the ominous attention of railroad managers.

The Baldwin Compound Locomotive.

In another page we publish a condensed report of tests made by Mr. George H. Barrus of a Baldwin four-cylinder compound locomotive at work on the Baltimore & Ohio Railroad. The tests were conducted with remarkable care and ability and no pains or labor appears to have been spared in making an accurate record of the performance of the engine. The comparative tests were made with an express train of three or of four cars, and the conclusions arrived at were that the engine saved about 15 per cent. of fuel compared with that used by the simple engine doing the same work, and that about 9 per cent. of the saving was due to the superior action of the exhaust of the compound locomotive upon the fire. This is not much of a recommendation for the compound locomotive, but we do not think that the test was a fair ordeal for demonstrating the fuel saving capabilities of a compound locomotive. From what we have observed ourselves and from what others have reported, we are led to believe that a compound locomotive must be loaded so that the steam in the high-pressure cylinder shall follow half stroke with the throttle full open in order to make decidedly economical use of the steam. As the load is lightened so that the cut-off must be accelerated or wire drawing increased, the saving compared to the performance of a simple engine diminishes, and a point is soon reached where there can be no saving of steam with a compound. We have good reasons for believing that a simple engine could be run empty with a smaller expenditure of fuel than a compound locomotive of the same capacity. The cause of this is so obvious that we need not discuss the particulars.

The Baldwin compound is a very ingeniously designed engine, but we do not think that it is built on the principle best calculated to make the compound locomotive a success. The increase of parts due to the use of four cylinders is certain to prejudice American railroad mechanical officers against that type of engine, for they have been striving very assiduously for years to simplify railway machinery, and they are not likely to look with favor upon an engine that uses two cylinders where one might suffice. Apart from the mechanical objections, there are the best of reasons for believing that the steam cannot be used so economically when divided into two parts as when kept in one volume. The peculiar cylinder arrangement of this engine dispenses with the use of a receiver. This does not appear to be an improvement. The indicator diagrams show that the compression in the high pressure cylinder at high piston speed is enormous, and is much in excess of that in compound locomotives provided with a receiver and operated under similar conditions. With this style of steam distribution, the release in the high pressure cylinder must be at the same moment as the admission to the low pressure cylinder. This calls for closer adjustment of mechanism than can be maintained readily in locomotives. The best form of compound locomotive lacks in elasticity as compared with simple engines, and a decided fault of the non-receiver compound is that this serious defect is magnified.

Locomotive Engineers and Federation.

The Brotherhood of Locomotive Engineers will meet in convention at Pittsburgh this month, and the delegates assembled will be called upon to settle a matter that is of considerable importance to railroad companies. The proposal to make the Brotherhood of Locomotive Engineers a part of a federated organization of railroad men has been for years urged upon the engineers by the weaker orders of railroad men. In the Eastern States the prevailing sentiment among engineers is to remain independent, but the federation idea is reported to have taken such firm hold of Western men that they are ready to fight the battle for change at the coming meeting. It is easy to understand the motives of the brotherhoods of firemen, conductors, brakemen, switchmen, etc., in seeking for a coalition with the engineers, for it is the weak seeking for the aid of the strong, but we entirely fail to understand what equivalent the weaker orders are prepared to give to the strong to pay for the sacrifice that would be made if the engineers undertook to make the cause of all railroad men their own.

The day may possibly come when a harmonious union of the skillful workman and the crude laborer shall be achieved, but every attempt of the kind has hitherto failed. Transcendent moral sentiment calls for the strong to give their support to the weak on the abstract principle of common humanity; but individuals have not generally responded to the high requirements of sacrifice, even when they are united as a brotherhood. When men's interests cease to be identical discord is certain to ensue, and discord is the beginning of disruption. It has been repeatedly proved in the working of trades unions that the only practicable and satisfactory basis of agreement is the perfect equality of all the members. The effect of this has been that all trades unions have tended to equalize wages irrespective of the skill of the workman. Should a federated organization of railroad employés, by a consolidation with the locomotive engineers, be made sufficiently powerful to present unreasonable demands on railroad companies with the

probability of success, the tendency would be to level pay upward. The engineer would be called upon to lift the condition of the brakeman, the switchman, and probably the trackman, to his own level, and take his share in paying the expense in any fights necessary to bring about this elevating process.

This is no fanciful theory. When the late dispute between the Railway Switching Association of Chicago arose and a settlement was made with the engineers, the switchmen struck for a raise of pay greater than that asked for by the engineers. A similar case arose on one of the Mackey roads where after obtaining the support of the engineers the conductors made a claim for higher pay than the engineers were satisfied with. It seems natural for every man to magnify the importance of his vocation. It would be difficult to find a conductor who did not consider that his duties were more important than those preformed by an engineer, and that he ought to be paid accordingly. Switchmen and brakemen reflect that their occupation is more dangerous than that of an engineer and that their pay ought to be based on the extra hazard to life and limb. Those interested in leveling pay upwards find no difficulty in making arguments to support that view of the case.

These considerations lead us to believe that the engineers have everything to lose and nothing to gain by uniting themselves with the other orders of railroad men. The engineers are now the aristocrats among labor organizations, and their members have never failed in obtaining justice from railroad companies when their demands appealed to popular support. If demands should be made that railroad companies considered unfair and which were opposed by public sentiment, a federated brotherhood would fail in securing them just as utterly as a single brotherhood would. A union with what has been proved to be habitually belligerent orders of railroad men would keep the engineers constantly in hot water with quarrels not their own, and with which they have no sympathy. There would be no weakness in a union with the firemen, for the interests of both classes of workmen are naturally entwined. If they join hands, however, with other orders, the Brotherhood of Locomotive Engineers are likely to find themselves used as a cat's-paw to pull chestnuts out of the fire for other interests to eat.

Station Indicators.

Very persistent efforts have been made to invent a station indicator for railroad cars that would notify to passengers the name of the approaching station. The unintelligible yell which the average brakeman gives as the name of next station makes an urgent demand for a reliable station indicator. The problem of producing the required device appears simple enough to the majority of travelers having an inventive tendency, and the Russianized enunciation of the brakemen is constantly suggesting that the invention be undertaken. The temptation is a dangerous snare but it catches many victims whose pocketbooks get fearfully attenuated before they finally conclude that there is no demand for a good station indicator. The line of invention generally followed is to devise an arrangement which will change at the time the train is starting, the card showing the name of the next station. This would work all right if there never was a stoppage between stations, but in train operating, stoppages not provided for in the schedule are constantly taking place, and as a result the train indicator gets away ahead of the train position. Some inventions make provision for the brakeman turning back the indicator when an extra stop takes place, but no railroad company will make use of a device for this purpose which needs to be helped out by the brakeman. They will rather use an indicator worked entirely by the brakeman.

In spite of the many failures and disappointments that have followed the inventing of station indicators other inventors are constantly coming forward to fill the breach left by those who have retired beaten from the fray. The latest candidate for sacrifice is a New York man who makes an attachment to the car axle and regulates the change of the indicator by the number of miles traveled. This might be made to work on a road where the car would always travel the same distance over the same route; but regulating the indicator to suit the varying distances between stations is a very complex problem. Putting the train into a side track or having to back up from any cause would throw all adjustments out of joint. We are afraid the perfectly automatic station indicator has not appeared yet.

Brakemen on Safety Appliances.

At a convention of railroad switchmen held at Buffalo last month resolutions were passed calling for hand holds on the ends of cars and that the height of drawbars be made uniform. Switchmen are the persons who suffer most from the absence of the safety precautions mentioned, and their wishes ought to be complied with without delay. It is now several years since the providing of hand holds on the ends of cars for the protection of trainmen was made a standard of the Master Car Builders' Association, and it is very discreditable to the railroad companies concerned that many cars are still running without hand holds. The same may be said concerning the standard and height of drawbar, only that the diversity results from the whims of men who persist in making their practices different from those of the majority. If the absence of hand holds and height of drawbar different from that established as standard by the Master Car Builders' Association were made evidence of criminal carelessness in cases of accident, there would probably be a greater disposition manifested to adopt standards that entail very little expense and are admitted to be important as safeguards.

The question of safety car couplers was also discussed in the Switchmen's Convention, and considerable diversity of opinion was expressed respecting what was the best type. A resolution was, however, carried by a large majority favoring the use of a link-and-pin coupler with a grooved face, which was practically an endorsement of the Safford type. The difficulty of coupling the M. C. B. type of coupler with couplers having the common draw head raises prejudice among switchmen against the couplers that have been adopted with a view of preventing accidents. The unsatisfactory condition of the rigging for operating the automatic couplers has also done a great deal to prejudice switchmen against automatic couplers generally. The attachments for handling the coupling mechanism of some makes can be depended upon to be out of working order. Petty grievances have generally led to the greatest revolts known to history. It looks as if petty defects were likely to condemn the M. C. B. coupler, for a coupler that has the enmity of the switchmen of the country is in a bad way, no matter what its merits may be.

Swing-beam Trucks.

There was an excellent discussion at last meeting of the Western Railway Club on the "relative merits of rigid center and swing-beam trucks," and the latter form of construction received the most searching criticism that it has ever been subjected to. Messrs. Peck, Rhodes, and Hickey gave so many good and sufficient reasons against the use of the swing center truck that the master car builders who specify this form of construction are likely to devote revived attention to analyzing the reasons on which their partiality for this form of truck rests. It appears to us that the record of expense of repairs ought to have condemned the use of the swing-beam truck long ago, when there was no decided reason for them; but the claim that cars carried on this form of truck were less fatiguing to the cargo than those carried on rigid centers no doubt prolonged the popularity of the swing-beam after the men responsible for keeping cars in running order had become anxious to abandon the use of a form that was so difficult to keep in good condition. The speakers at the club meeting now appear to have proven that the claim which has given an unnatural lease of life to the swing beam was a fallacy. At least a swing beam truck offers no advantages over one with a rigid center in the transportation of live stock and freight not particularly susceptible to hard riding. This appears to be now generally admitted to be true. We have, however, heard it frequently asserted that rigid center trucks could not be successfully used for carrying peaches and other kinds of fruit that have to be handled tenderly. In this case we believe that the proper mode of improved construction would be to use more elastic springs under a truck whose form of construction insured durability. A swing center truck may ride easier than a rigid center truck equipped with the same kind of spiral springs; but a rigid center truck equipped with elliptic springs would not cost more than a swing truck with spiral springs, and we believe that the former truck would carry a car more smoothly than the other and be its superior in every other respect. The question would, however, bear more investigation. We should be glad to hear on the subject from those having delicate freight to transport.

Many railroad officers do not appear to have come to a realizing sense of the change made in the Master Car Builders' rules of interchange at the last convention making it permissible for any road to use in the repair of foreign cars any articles that conform to the Master Car Builders' standard. The practice only became legal on September 1. Although the use yet made of the privilege has been very limited, there are indications that the change of rules will bring considerable business to the Arbitration Committee in the settlement of disputes. The Master Car Builders' type of drawbar promises to be a fertile subject of misunderstanding. If the connections of all standard couplers were uniform the replacing a broken one with a bar of another make but of the same type would be a simple matter. But there is already great diversity in the draft attachments to the drawbar, and in connections used for operating the coupling mechanism, and this gives the car inspector anxious to make his mark the opportunity to demand a card. It would greatly simplify matters if the Arbitration Committee would make an early ruling to the effect that the alteration of draft and coupling attachments to suit a M. C. B. coupler different from one replaced does not call for the use of a card. That would be a common sense ruling that all members of the association not anxious to be overreaching would endorse.

The Master Mechanics' Report.

The twenty-third annual report of the American Railway Master Mechanics' Association has been delivered to members and others. It is a volume a little larger than last year's report and got out in much the same style. An improved feature of the report is that it contains a list of the standards which have been adopted by the association. It is to be hoped that having a record of the standards at hand, master mechanics will display a greater tendency to adopt them. This is particularly desirable in the case of driving wheel centers and form of locomotive tire.

The full discussions that took place at last convention as published in the report make highly interesting reading, particularly these on the fitting of bolts, on the use of the pony truck and on compound locomotives. The report bears the imprint of Newark, N. J., and its mechanical execution is remarkably good. The paper is better than anything that had been previously used, and the good quality makes a decided improvement on the volume.

In the regions where the feed water is badly impregnated with lime impurities there is great difficulty experienced in getting blow-off cocks kept in working order. Mud drums have been placed on the bottom of boilers under the point where the feed water is admitted, and great benefit was anticipated from their use, but in nearly all cases they proved failures, principally because the blow-off cock that was provided for ejecting the mud could not be kept tight. A leaky cock at that part of the engine is an annoyance that would not long be tolerated, and the cock on the mud drum was never opened or it was taken off altogether. We think that the failure to maintain this highly efficient means of keeping the boiler clean and in working order was not creditable to the men responsible for keeping the locomotives in running order. If half the attention had been bestowed upon the attachments to the mud drum that are often freely given to keeping patented devices in working order, the mud drum would have proved a very successful auxiliary in preventing the damage that arises from mud and scale charged boilers. A plug valve cannot be kept long tight where the water is bad, but there are several kinds of special forms of globe valve that are reputed to be durable under the most trying conditions, and we have lately heard of a simple form of gate valve working very well as a blow-off cock. We consider that it would be work well expended for the committee of the Railway Master Mechanics' Association having the Purification of Feed Water on hand to devote attention to an investigation of how far ordinary appliances have been made successful in keeping boilers clean. We know of two roads running in a district where the same kind of feed water is used and the boiler repairs of one of the roads is about 25 per cent. more than the other. The cause of the difference is evidently in the use of ordinary means to keep the boilers clean.

A stock company has been formed in Chicago and incorporated under the name of the Railway Brotherhood Hospital Association. The incorporators profess to represent the Brotherhood of Locomotive Firemen and say that the object of the company is to establish hospitals for the sole benefit of railroad men all over the country. We have not heard of any railroad men having any hand in the movement and we believe it an attempt to deceive people, and that is stating the case in the most charitable way we can express it. Men who form stock companies for pretended philanthropic purposes are generally worth watching. We would strongly advise railroad men to refrain from investing with the hospital association.

At the recent meeting of the American Association for Advancement of Science, Professor Denton, of Hoboken, N. J., gave, in the course of an address, the history of mecanical tests to ascertain the value of lubricants. He held that the method of tests which generally measured the coefficient of friction to artificially smooth surfaces supplied to excess with lubricants did not produce results that were of value. The only practical way to test lubricants was to make the conditions of the testing machine bearings approximate the ordinary conditions found in practice, where abrading of surfaces took place and where heating resulted from restricted supply of oil.

The object of the most persistent invention continues to be the car coupler. Within a month over 30 new car couplers have been patented and most of them are of such shape that no sane railroad man would think of risking them as an attachment to his cars. There is an idea abroad that a great fortune can be made out of a successful car coupler. This may be the case, but it will be difficult for any inventor or company to make half the money on a car coupler that has been spent on the invention of worthless devices.

Two superintendents belonging to the Burlington & Missouri River road were arrested in Lincoln, Neb., last month, for contempt of court for trying to prevent a street railway from crossing the company's tracks. Both were heavily fined. Railroad officers are justly indignant when their employés or others try to override the law, but many of them are very ready to show a bad example by themselves wantonly defying the law.

Personal.

Mr. Charles B. Couch, for some years superintendent of the Lake Shore, has been appointed purchasing agent.

Mr. David Oxley, who has been Master Mechanic of the Illinois Central shops at Centralia, Ill., for 30 years, has been retired on half pay.

Mr. W. J. Hallet has been appointed Assistant Master Mechanic of the Cincinnati Division, Chesapeake & Ohio Railway, vice Mr. W. J. McKee resigned.

Mr. L. W. Schafer has been appointed master mechanic of the Second Division of the L., N. A. & C., with headquarters at Lafayette, Ind., to succeed Mr. Joseph Coburn, resigned.

Mr. J. V. Patton has been appointed general manager of the Pittsburgh & Western Railroad. He was previously superintendent of the Pittsburgh division of the Baltimore & Ohio Railroad.

Mr. J. R. Taylor has been appointed assistant general manager of the Knoxville, Cumberland Gap & Louisville Railroad. He was for some time general manager of the Rome & Decatur Railroad.

Mr. H. P. Latta has resigned as Division Master Mechanic of the Lake Shore & Michigan Southern at Norwalk, Ohio, to accept the position of Master Mechanic of the Chicago & Erie, with headquarters at Huntington, Ind

Mr. I. S. Emery, general manager of the Rome, Watertown & Ogdensburg, who is highly popular personally among the people of all classes in his district, has been nominated for Congress by a convention of workingmen.

At the September meeting of the Western Railway Club Mr. J. N. Barr was elected president; Mr. C. A. Schroyer, first vice-president; Mr. P. H. Peck, second vice-president; Mr. Allen Cooke, treasurer, and Mr. W. D. Crosman, secretary.

Mr. L. C. Higgins, purchasing agent of the Lake Shore & Michigan Southern, died at Cleveland, O., Sept. 1, aged 42 years. He had been connected with the Lake Shore road for many years and had been purchasing agent since 1884.

Mr. Max Nathan, head of the Nathan Manufacturing Company, was ordered in the spring by his physician to go to Germany owing to the precarious condition of his health. He has returned home lately looking stout and hearty.

Mr. L. C. Noble, general master mechanic of the Houston & Texas Central, is about to retire from railroad service and devote the whole of his time to business connected with his nut lock, which is meeting with great demand for track work.

Mr. W. R. Busenbark has been appointed assistant general manager of the Chicago, St. Paul & Kansas City Railway. He was for several years general passenger agent for the company at Chicago, and it is understood that his new duties will relate mostly to traffic business.

Mr. A. S. Ostrander has been appointed superintendent of the Shore Line Division of the New York, New Haven & Hartford Railroad. Mr. Ostrander has been a conductor on the road for several years, and is reputed to be well posted on the duties a superintendent is required to perform.

Mr. Alva Mitchell, for several years general foreman of the Wisconsin Central shops at Waukesha, has been appointed master mechanic of the Southern Kansas division of the Atchison, Topeka & Santa Fe. Mr. Mitchell was for years with the Central Iowa, and is a particularly good shop manager.

Mr. E. C. Brown has resigned as General Superintendent of the Michigan Central road on account of failing health, and has been appointed assistant to President Ledyard, in which position he will have easier duties. Mr. Brown was a particularly successful operating officer, and was noted for his ability in managing men.

Mr. William Wilson, for years superintendent of machinery of the Chicago & Alton Railroad, is about to move his residence from Bloomington, Ill., to Chicago. The enginemen belonging to the Chicago & Alton lately made a surprise visit in a body to Mr. Wilson's home, and presented him with a silver dinner set as a token of their regard.

The motive power departments of the James River, Richmond and Peninsula divisions of the Chesapeake & Ohio will henceforth be operated under the supervision of Master Mechanic T. S. Lloyd, whose headquarters will be at Richmond, Va. Mr. W. J. Haller has been transferred to the Cincinnati division, with headquarters at Covington, Ky.

Mr. E. B. Thomas, who has been appointed general manager of the Chicago & Erie road, will retain his position as second vice-president of the New York, Lake Erie & Western, of which the Chicago & Erie is a part. A report was circulated that Mr. Thomas would move his office from New York to Chicago, owing to his taking charge of the Chicago & Erie, but it was unfounded.

Mr. Frank Moore, assistant superintendent of the Westinghouse Air Brake Company, has invented a new quick acting triple valve, which appears to possess valuable features. Mr. Moore is a nephew of Mr. Westinghouse, and appears to have inherited in no small degree the inventive genius of his uncle. Some of the most valuable features of the present engineers' valve originated with Mr. Moore, who, by the way, is one of the most genial young men to be found in the great State of Pennsylvania.

Mr. Robert Miller, who has been assistant general superintendent of the Michigan Central since 1884, has been made general superintendent, succeeding Mr. E. C. Brown, who retires on account of ill-health and is appointed assistant to the president. Mr. Miller has risen from the car department, and he has hosts of friends among the car builders of the country who will be gratified to learn of his good fortune, which was thoroughly deserved and industriously earned. Mr. Miller went to the Michigan Central in 1876 as master car builder. Previous to that he was for 18 years connected with the mechanical department of the Chicago, Burlington & Quincy, his last position with that road being general foreman of the Aurora car shops, which he held for eight years.

Mr. George D. Harris, who during the past two years has been in charge as Master Mechanic of a division on the Richmond & Danville, stationed at Salisbury, N. C., has received the appointment of Superintendent of Motive Power of the Georgia Southern & Florida, headquarters at Macon, Ga. The Georgia Southern & Florida is to be congratulated in securing the services of a man so well equipped for the work which lies before him, that of organizing and laying the foundations for a plant to meet immediate and future requirements. He is methodical, a good handler of men, and his shops always smack of an air of neatness which is most pleasing, and we believe profitable to the interests represented. We wish him every success in his new field. This new Southern road is dubbed "The gilt-edged of the South," and justly so.

New York & New England Railroad Notes.

During a brief visit to the New York & New England Railroad shops at Norwood, we found Mr. Albert Griggs pushing forward very vigorously the work of putting the rolling stock in first class order. Mr. Griggs has been celebrated for efficient shop management, his arrangements for doing work well and expeditiously while he was on the Providence & Worcester, having been second to nothing found in New England. There is every appearance that the Norwood shops will soon attain a similar enviable condition.

This company is using some chemical for mixing with the coal burned in locomotive fire boxes which is reputed to prevent smoke and effect improved combustion. I rode on several of the engines and found that there was very little smoke to be seen, but I also noted that the firemen did their work with extraordinary care and skill. My experience has been that a careful fireman makes a remarkably successful smoke consumer. It was very apparent to all concerned in the locomotive engine running of this road, that the head of the mechanical department was watching the performance of his men. Where this is the case, there is not likely to be reason for complaint about smoke or any other nuisance. The health authorities of Boston might with edifying results note the smoke-raising practices of the locomotives belonging to some of the companies running into the city, and contrast their appearance with those of the New York & New England locomotives.

I rode on a locomotive pulling one of the fast express trains on the New York & New England, and found an ideal engineer running the engine. He worked the train into the running speed as quickly as the nature of the track would allow, regulating the work by the reverse lever; when the running speed was attained he kept it steady by varying the cut-off to suit the lie of the track. When descending grades the lever was pulled back close enough to hold the speed steady, and when a rise was encountered the lever was gradually advanced to meet the extra requirement for steam. His mind appeared to be entirely occupied in watching his engine and the signals that controlled the train. The water was kept steady at one level and the air brake was handled so that checking of speed and stopping were done so gradually that the change in velocity was scarcely perceptible. This engineer was an intelligent, reading man, well posted in the literature of his business, and he is justly acknowledged to be one of the most valuable men in the service of the company.

A. S.

Merit of Working Close.

A machinist is supposed to be a close workman, else his fits will be bad. Suppose a machinist bores his pulley just so it will move on to the shaft with no slack or rock to it; fits and touches the shaft all round, then a key fitted so a few blows of a 2-pound hammer will send it home. The job is done well and stands the work well without getting out of place. Then again, suppose he says: "There is no need of this painstaking; if it is bored 1-64 large the key will take up the slack, and it will do just as well, and save a lot of careful and close observations," and give him time to gab with his neighbor workman, hindering both. The result is, the pulley gets loose in a short service, and the proprietor drives in a shim; then the pulley wabbles and gets out again quicker than ever, wears the shaft and goes from bad to worse, until the shaft is upset and turned again. Now here is a loss in time and patience and nervous energy, all gone to the dogs from not "working close."

But you will note this—the shaft was not lost, neither was the pulley. But when a sawyer says: "There is no need of this 'fuss puttering' on an arbor to have the collars just right, and the saw filed all alike; every tooth square front or at right angles with the plate, well rounded and full set and in line: it may go bad once in a while, but I can't bother my brains—don't get pay enough." But when he saws a board $\frac{1}{8}$ inch too thin it goes in the culls and is lost in that grade; or if too thick it is sure to have its counterpart in a thin board at the tail end. This is loss, actual loss; so why should not a sawyer be a close workman as well as a machinist? The fact is that a good filer is a closer workman than a machinist; for he works free hand, and his saw has to run free hand, except what he guides hold it, which avails but little if it is inclined to go wrong.

A saw-hammerer says: "Now, if I get the tension or strain right in hammering, the trueness of the plate does not matter much. It is irksome to come down to fine close observation in trueing the plate." So he lets it go, off and on, on the edge of the saw; his saw flutters and trembles on the edge, cuts back close, and makes diamond tracks on the board; when, if the hammerer had worked close, he might have saved all this. The fact is, there is more trouble from this cause than any other—in the mill hammerer than from the shop hammerer. The maker must have his plate true to sell. The fault with the shop hammerer is more in not getting the right strain in the plate. He leaves his plate true, almost invariably; while the mill hammerer leaves his plate almost invariably out of trueness.—*C. E. Gandy in Mechanical News.*

An English Dining Car.

We take the following description of an English dining car from a foreign exchange:

"The London & Northwestern Railway Company have recently built for service on their lines to the north of England two dining cars, which show a considerable improvement on the saloons at present used for the purpose. Each car consists of two ordinary wagons coupled by a gangway, which can be disconnected, if necessary, in a few moments. At one end are the kitchen and pantry, fitted with a gas stove of the latest make and with capacious cupboards and presses. Here dinners of an elaborate character can be prepared, since all the conveniences of a modern kitchen, including a large refrigerator, are found in the smallest possible space. Electric bells, communicating with each table, serve to attract the attention of the waiter to the travelers who desire to dine. The saloon itself is divided into three compartments, one of which is reserved for smoking. The passengers sit facing each other, between them being a table, which can be folded up when not required. The decoration is extremely good, the panels between the windows being of inlaid walnut. The sides and part of the roof are embellished with Lincrusta-Walton paper. Excellent lavatory accommodation is provided, and the cars are lighted by softly-shaded lamps supplied with oil gas. The fares charged are to be at the ordinary first-class rates, but the saloons will be occupied only by such passengers as intend to dine. The dining charges will be fairly moderate, the culinary arrangements being in the hands of the management of the company's hotel. The new cars are to go into service immediately."

The Electric Motor for War Trains.

It is proposed to use the electric motor extensively in military operations in England. One of the latest ideas in carrying on active warfare is to build a railway at the scene of hostilities for the transportation of ordnance. It is highly desirable that the trains used for this purpose which are armor plated and armed with Gatling guns should be as rapid and inconspicuous as possible. The use of steam for them is open to grave objections, one of which is that coal smoke is an excellent guide by which an enemy could trace the progress of an engine and lay its guns for it accordingly. The electric motor is quick and silent, and has no smoke to betray its whereabouts, and it is remarked is the coming mode of propulsion for war trains.—*Electrical Review.*

Compound Locomotives.*

BY PROF. ARTHUR T. WOODS.

Twelfth Paper.

AMERICAN COMPOUND LOCOMOTIVES.

AMERICAN PATENTS.—There are apparently but few United States patents which bear on the subject of compound locomotives, and most of these are of very recent date. The following list includes all which the writer has been able to find which appear to be of interest to designers of compound locomotives, although it is not improbable that others exist, carefully hidden by the erratic style of indexing adopted by the Patent Office. No attempt has been made to determine the breadth of the claims in any case.

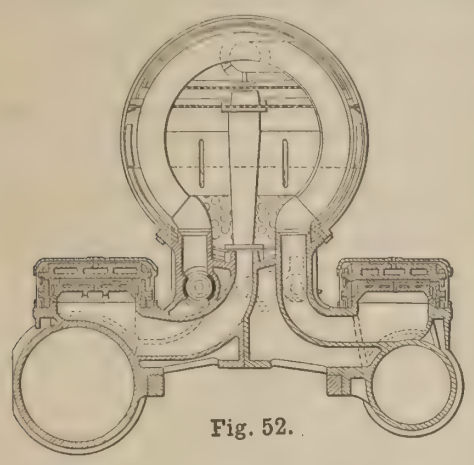


Fig. 52.

H. D. Dunbar, No. 264,937, Sept. 26, 1882; 276,368, April 24, 1883. Slide valves for tandem compound engines.
E. G. Davis, No. 274,571, March 27, 1883; 279,544, June 19, 1883. Slide valve for tandem compound engines.
W. B & J. A. Johnson, No. 351,921, Nov. 2, 1886. Four-cylinder compound locomotive, with one receiver connected to all four-cylinders.
T. W. Worsdell, No. 360,834, April 5, 1887. Compound engine with intercepting valve, substantially as previously described.
A. von Borries, No 361,471, April 19, 1887. Compound locomotive with intercepting valve, substantially as previously described.

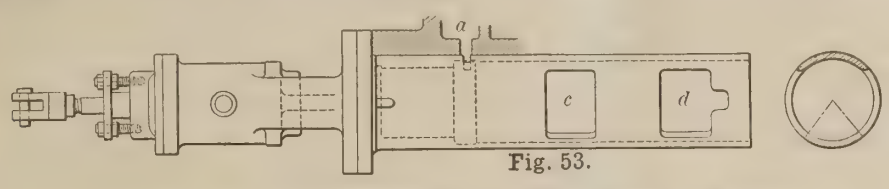


Fig. 53.

Fig. 54.

R. Lindner, No. 404,295, May 28, 1889. Starting gear for compound locomotives, substantially as previously described.
R. H. Lapage, No. 405,569, June 18, 1889. Compound engine with intercepting and starting valve.
R. H. Lapage, No. 405,570, June 18, 1889. Bogie compound locomotive with high pressure cylinders on main frames and low-pressure cylinders on a bogie truck.
S. M. Vauclain, No. 406,011, June 25, 1889; 406,012, June 25, 1889. Four cylinder compound locomotive with one or two piston steam-distributing valves.
A. J. Pitkin, No. 417,083, Dec. 10, 1889. Two-cylinder compound locomotive with piston intercepting valve.

THE DUNBAR SYSTEM.—A four-cylinder compound locomotive was built by the Boston & Albany Railroad Company in 1883, under the Dunbar patents. The cylinders were 12 inches and 20 inches in diameter, by 26 inches stroke, and were arranged tandem with the high-pressure and low-pressure pistons on the same piston rod. The engine could be worked compound or non-compound at will. After working about seven months the locomotive was changed to a simple engine as it was apparently no more economical than the simple locomotives. It is stated that the ports were too small and that the inventor was absent during the trial. As the locomotive was an experiment it is not surprising under the circumstances that the results were unsatisfactory.

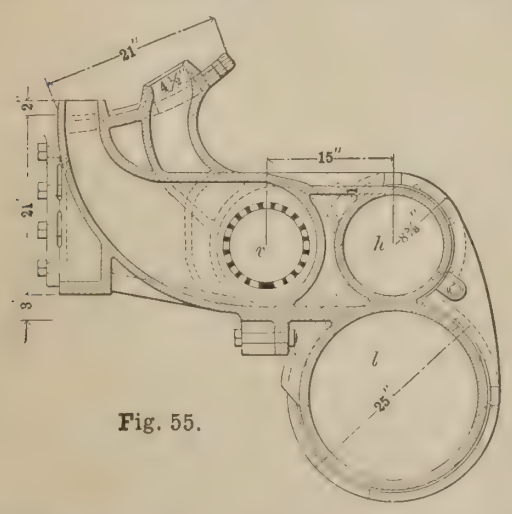


Fig. 55.

THE PITKIN TYPE.—A two-cylinder compound locomotive designed by Mr. A. J. Pitkin and built at the Schenectady Locomotive Works was put to work on the Michigan Central Railroad in September, 1889. The general arrangement of the cylinders and steam connections of this locomotive is shown by Fig. 52. The distinctive feature of the engine is the intercepting valve, which is shown by Fig. 53 which is a plan of the bushing which incloses the valve and by Fig. 54 which is a vertical section through the valve, bushing and saddle.

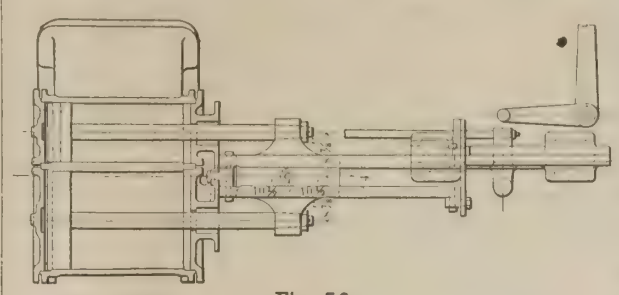


Fig. 56.

The valve is shown in the position which it occupies in starting; that is, before compound working begins. In this position the ports *c* and *d* are closed by the intercepting valve and the connection between the low-pressure steam chest and the receiver is thus cut off. The small port *a* (Fig. 53) is connected by a pipe and a pressure-reducing valve to the high-pressure steam pipe. By this means steam at reduced pressure is admitted to the space *b* and thence, as indicated by the arrow, to the low-pressure steam chest. As the parts of the valve on either side of *b* are of different diameters, the pressure in this space tends to hold the valve in the position shown in Fig. 54. When the locomotive starts, the high-pressure cylinder exhausts into the closed receiver, and the back pressure thus created acts upon the forward end of the intercepting valve by means of the passage shown at *e*. The pressure in the receiver rapidly increases until the total pressure on the forward end of the valve is sufficient to overcome the total effective pressure at *b*, when the valve is forced to the back end of its stroke, the direct steam supply to the low-pressure cylinder is cut off and compound working begins. To prevent the valve moving too rapidly a dash-pot in the form of an oil cylinder, *h*, is added. The valve stem is continued through this oil cylinder and is connected by levers to an index in the cab which indicates the position of the valve.

The locomotive fitted with this intercepting valve has now been at work for several months with apparently satisfactory results. While its fuel saving capabilities have been demonstrated, it has not been thoroughly tested against a simple locomotive of proper dimensions to make a satisfactory comparison possible. The dimensions of this locomotive are as follows:

Diameter of h. p. cylinder	20 in.
" l. p. "	29 in.
Stroke of pistons	24 in.
Ratio of cylinder volumes	2.1
Size of steam ports, h. p	18 in. × 1⅛ in.
" " " l. p.	20 in. × 2⅛ in.
" exhaust ports, h. p.	18 in. × 3 in.
" " " l. p	20 in. × 3 in.

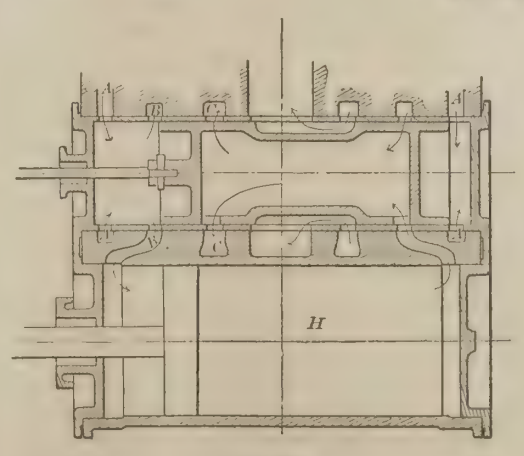


Fig. 57.

Maximum travel of valves	6½ in.
Lap of valve, h. p., outside	1 ⅜ in.
" " " inside	— ⅜ in.
Lap of valve, l. p., outside	1⅛ in.
" " " inside	— 1-16 in.
Lead, full gear	5-32 in.
Number of driving wheels	6
Diameter of driving wheels	68 in.
Style of boiler	Wagon top.
Diameter of shell outside first ring	58 in.
Thickness of plates, steel	9-16 and ½ in.
Size of firebox, inside, length 96 3-16 in.; width	42¾ in.
Tubes, 247, 2 in.; length over tube sheets	12 ft.
Heating surface, tubes	1,540.3 sq. ft.
" " firebox	137.1 sq. ft.
" " total	1,677.4 sq. ft.
Grate surface	28.5 sq. ft.
Total weight in working order	126,800 lbs.
" " on driving wheels	97,000 lbs.
T tal wheel base, engine	22 ft. 6 in.
Driving wheel base	12 ft. 2 in.
Rigid wheel base	6 ft. 3 in.
Total wheel base, engine and tender	48 ft.

As built, the high-pressure valve had neither inside lap nor clearance; the low-pressure valve had ⅛ inch inside lap, and the lead of both valves was $\frac{3}{32}$ inch. These proportions have been changed to those given in the table of dimensions. In addition to this, the volume of the receiver has been increased from that of the high-pressure cylinder to 1½ that volume, and the high-pressure clearance has been increased from 8½ to 10 per cent. of the piston displacement. These changes were made after the indicator had demonstrated their necessity, and it will be seen they are entirely in accord with the proportions already recommended in these pages. Other locomotives of this type are now being constructed.

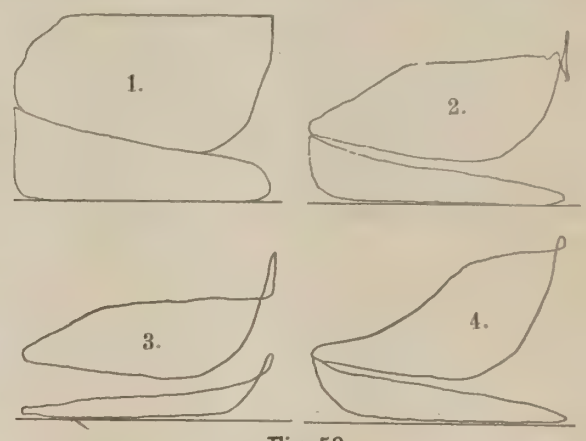


Fig. 58.

THE VAUCLAIN TYPE.—A locomotive of this type was built by the Baldwin Locomotive Works in the fall of 1889, and was put to work on the Philadelphia Division of the Baltimore & Ohio Railroad. The general arrangement of the cylinders and valve is shown by Figs. 55 and 56. Referring to Fig. 55, *h* is the high-pressure cylinder, *l* is the low-pressure cylinder, and *v* is the valve bushing. The method by which the power from both cylinders is transmitted through one cross-head is shown in Fig. 56, which also shows the direct connections of the valve. The steam distributing valve is a hollow piston valve, the action of which is illustrated by Fig. 57, which represents a longitudinal section through the valve and the high-pressure cylinder. Steam from the boiler enters the steam chest through the ports *A*, *A*, and passes thence by the port *B*, as indicated by arrows, to one end of the high-pressure cylinder. The exhaust from this cylinder passes through the valve to the port *C*, and thus to the low-pressure cylinder. The exhaust from the low-pressure cylinder passes around the outside of the central portion of the valve, as indicated, to the exhaust pipe. The method of distribution thus resembles that with the Dudgeon slide valve, which was at one time used for marine compound engines.

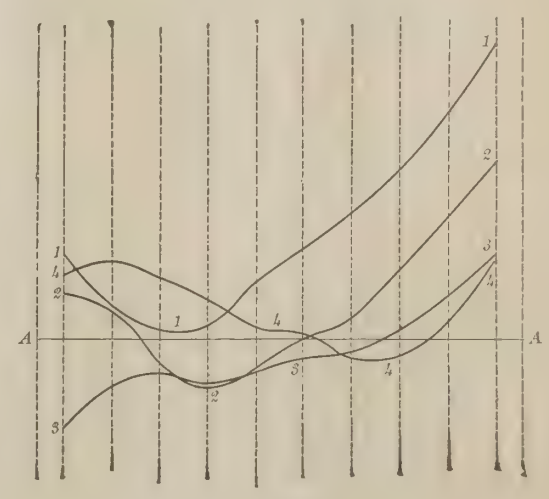


Fig. 59.

The feature of this design which at first glance would seem to be most open to criticism is the connection to one cross-head of two pistons of which the centers are about 18 inches apart and on which the total pressure must vary considerably. To determine the amount and variation of this difference of pressure with reasonable exactness an examination of a large number of indicator cards taken simultaneously from both high and low pressure cylinders would be necessary. Some knowledge of the subject can, however, be gained from the examination of a few cards, and for this purpose the indicator diagrams shown in Fig. 58 have been selected from a blue print sheet furnished by

*Copyright, 1889, by Arthur T. Woods.

the builders of this locomotive. The data for these diagrams are given as follows:

Card No.	Rev. per min.	Miles per hour.	Cut-off h. p. cyl.	M. E. P. h. p. cyl.
1	54	11	20″	100
2	218	44	17″	65
3	300	60	17″	47
4	150	30	9″	58

Card No.	M. E. P. l. p. cyl.	M. E. P. l. p. ref. h. p.	Horse power.	Per cent. of work by l. p.
1	50.	139	353.8	58
2	27.	75	836.7	54
3	16.	44	753.2	48
4	24.5	68	607.2	54

In making this comparison it has been assumed that the diagrams from the two ends of the cylinders are alike in each case. The diagrams were divided by ordinates as in Fig. 59, and the difference between the forward pressure on one side of each piston and the back pressure on the other side was plotted for each ordinate. A curve was thus established which represented the net effective pressure on each piston for various piston positions. Then the differences of the ordinates of these two curves gave the curves shown in Fig. 59. The numbers of the curves in this diagram refer to the correspondingly numbered indicator cards of Fig. 58, and the vertical distances above the base line *A*, *A*, represent the excess of the total pressure on the low-pressure piston above that on the high-pressure piston. Distances below the base line mean, of course, that the total pressure upon the high-pressure piston exceeds that on the low-pressure piston. The scale of pressures is about nine thousand pounds to one inch, and the stroke is taken to be in all cases from right to left. It will be seen that the greatest difference in pressure is for the diagram taken at slow speed and late cut-off, and that for high speed and early cut-off the difference is comparatively small. Also that, according to curves 2 and 3, the effect of higher speed and lower initial pressure with the same cut-off is to greatly change the amount and distribution of the excess pressure. The scale to which Fig. 59 has been constructed is not sufficiently large to make the results entirely trustworthy, but the curves are sufficient to show that the variation in total pressures at ordinary running speeds is approximately 5,000 pounds. The tendency is to tip the cross-head, and hence to bring an additional bending load on the piston rod of the underloaded piston, which would apparently be most severe where this rod enters the cross-head. It does not follow that this fact is an argument against the adoption of this design, but simply that a varying load of, say, 5,000 pounds acting with a leverage of about 18 inches, and having from 300 to 600 reversals per minute at ordinary speeds, is worth considering, and should be provided for in addition to the usual stresses on piston rods.

The principal dimensions of this locomotive are as follows:

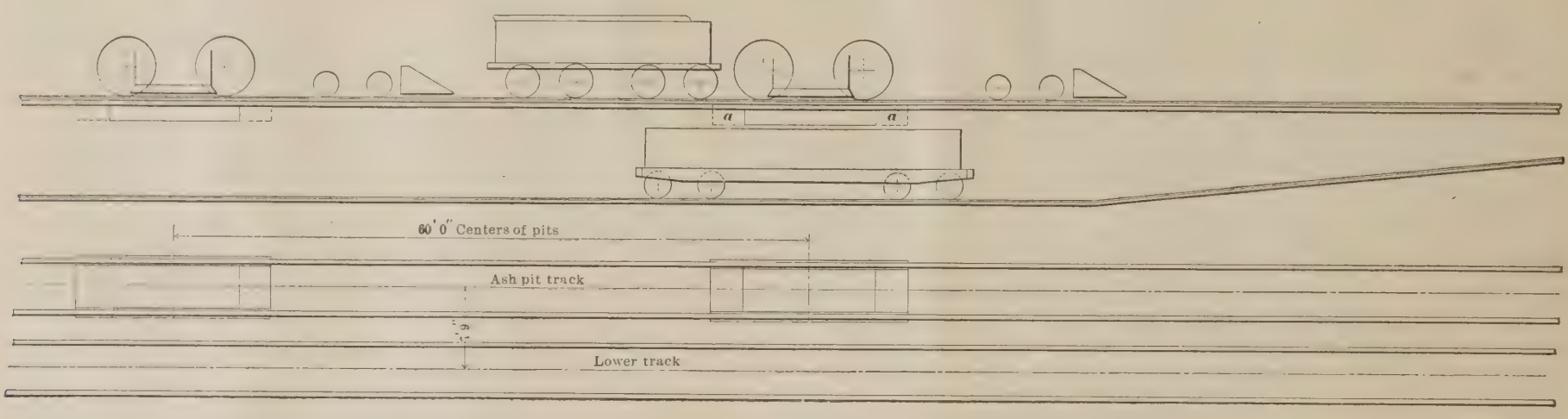
Diameter of h. p. cylinders	12 in.
Diameter of l. p. cylinders	20 in.
Stroke of pistons	24 in.
Ratio of cylinder volumes	2.78
Number of driving wheels	4
Diameter of driving wheels	66 in.
Style of boiler	Wagon top.
Diameter of shell	58 in.
Thickness of shell, steel	½ in.
Size of fire box	length, 108 in.; width, 34 in.
Tubes, 251, 2-in., length	11 ft. 10 in.
Total weight in working order	105,000 lbs.
Total weight on driving wheels	75,000 lbs.
Total wheel base, engine	21 ft. 10 in.
Driving wheel base	7 ft. 6 in.
Total wheel base, engine and tender	50 ft.

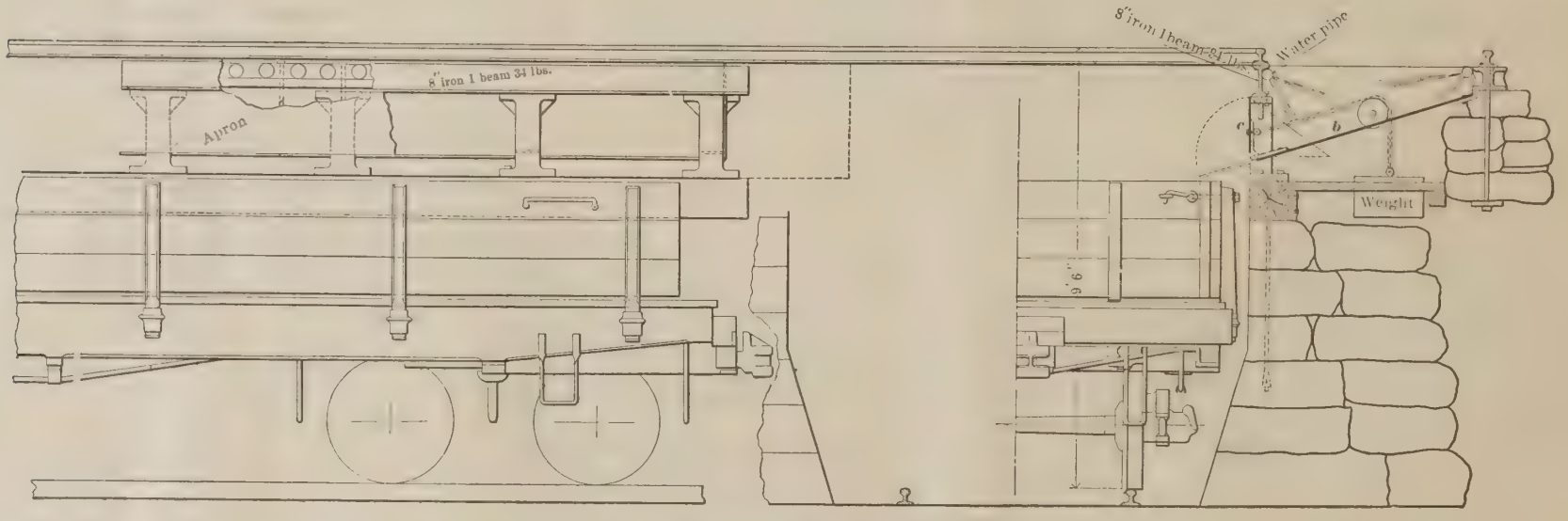
Labor-Saving Ash Pit.

Owing to the large number of engines which have to be cleaned at several points on the Atchison, Topeka & Santa Fe Railroad, the limited time and room to store ashes, etc., it became necessary to design ash pits which would accommodate a large number of engines and allow of the speedy removal of the ashes. With these conditions in view, under the direction of John Player, S. M. P., the pits shown in the engravings were designed.

As will be seen, the arrangement is two pits or two surface tracks, between which is a lowered track, on which coal cars are placed to receive the ashes. Engines coming into the pits have their ash pans cleaned by a man who stands in the end or sub pit at the end of the main pit. He pulls the ashes into the main pit from the ash pan. The main pit will hold the ashes of from five to seven engines, and when full the end gate is released by knocking up the latch. This gate then drops into a line with the bottom of the main pit (which is inclined as shown), and forms a continuation of it, so that the ashes may be conveyed into the car as shown. This is accomplished without manual labor by turning water from the mains into the pipes as shown. These pipes have slits or openings $\frac{3}{16}$ by 8 inches, extending the full length of each pipe, which openings are placed so as to throw water over the top of the ashes, and also a sheet of water between the ashes and bottom of pit, which acts as a lubricator or vehicle between the ashes and pit bottom, sweeping the whole pitfull of ashes into the car. The water also keeps down dust and quenches any fire in the ashes. As the pitfull can be emptied into the car in less than a minute, or in much less time than an engine can move off the pit and another come on to be cleaned, it will be seen that the arrangement is well calculated for speedy work. The pits are placed opposite each other, on each side of the lowered track, thus loading equally into each side of the car. It is estimated that 40 engines can be cleaned in one hour on the four pits, so that the capacity is very large. Sufficient space is left between each pit on the same surface track to allow of two of the largest engines standing each over a pit, and of course they can be cleaned headed either way. It appears to be a good plan to locate these pits opposite the coal chutes and water tank, adding a sand-drying house also to the coal chutes so that an engine may be cleaned of ashes, take coal and water, and sand through a pipe similar to a water tank pipe at the same time, a fender being placed so that no coal can go over the side of the tank on to the lowered track.

The water from the ash pits is conveyed off by sewerage under the lowered track, fine grated openings being provided as entrances to the sewer. These pits do away with all manual handling of ashes, save pulling them from the ash pan of engine, and combine in a small space immense facilities for cleaning any number of engines, with the advantage of leaving the ashes and cinders from extension front ends loaded for the track department.





LABOR-SAVING ASH PIT.

Early Prejudices Against the Steam Pump.

Perhaps one of the best examples of a mechanical device working its way into great prominence against early-prejudices is found in the steam pump. When the late Henry R. Worthington invented his direct-acting steam pump, and proposed to use it for feeding boilers, says the *American Machinist*, he was met by engineers to whom he showed it with remarks to the effect that, while it was ingenious and all that, no one wanted such a pump. This was the first reception of a machine which in various forms and modifications, made by different manufacturers and for different purposes, is in use in every civilized country in the world and on board every steamship. No one doubts its utility or its influence on mechanical progress. Perseverance won in the instance of the steam pump, as it has in the instance of many other inventions. It is not wise to drive bullheaded against all mechanical opinion, and it is equally unwise to be turned aside by every contrary opinion. Mr. Worthington's belief in himself has been an excellent thing for the world.

A combination railroad cross-tie has been patented by Robert Whiteford, a practical trackman of Louisville, Ky. The tie provides for wooden blocks as supports for the rail, secured to a casting made with suitable recesses for the blocks mentioned. The obtaining of letters patent appears to have been a family concern, interest in it being assigned to Patrick Bannon, Dennis Shannahan, Michael O'Sullivan and Matt. O'Doherty.

An important improvement on his well-known feed water purifying device has lately been patented by Mr. J. B. Barnes, of the Wabash Railroad. He provides for a false shell between the flues and the outside of the boiler, extending a little above the ordinary water line, making a recess into which the feed water passes. The object is to retain the impurities away from the heating surfaces, and provide for their removal before they have the opportunity to form scale or cover mud over the hot surfaces.

The latest piston rod metallic packing offered for railroad use was patented by D. Hanney, Turner, Ill. It consists of two eccentric packing rings with a band spring encircling them, a split ring sleeved upon the rod opposing the inner eccentric ring, a sectional ring fitting thereon, and a band spring binding the split and sectional rings. A collar and coiled spring are used to keep the packing compact and to press it upon the piston rod. The packing is on some locomotives belonging to the Chicago & Northwestern railway, and is favorably spoken of.

Communications.

Boiler Seams.

Editor National Car and Locomotive Builder :

Two of the most important factors in boiler construction are the mode of joining the sheets and bracing the flat portions of the boiler.

For many years, although in Europe the method had been changed, American railway master mechanics continued to use the lap joint for the first purpose and crown bars as part of the second, maintaining, with a faith worthy of a better cause, that they were the best. Of late years this faith seems to have been shaken, and we find many departures from the manner of doing the work of joining the longitudinal seams of the sheets; and we have now three methods, namely, the lap joint, the lap joint with an inside welt, and butt joint with an inside and outside welt.

The lap joint has two special weaknesses, namely, that of the sheets across rivet holes without an opportunity of reinforcement, and that the lapping of the sheets places them without the line of strain when a pressure is on it.

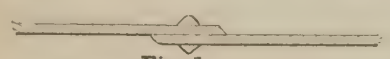


Fig. 1

That the last is a defect, and a serious one, was recognized in Europe many years ago and proven by riveting two strips of boiler plate together as shown in Fig. 1 and subjecting them to a pulling strain when it was found that the lap assumed the shape as shown in Fig. 2. Repeated applications of the strain showed that the fibers of the metal were strained and broken at the points *a*, and removed any doubt that there might be as to the cause of the sheets furrowing at these points. This led many of our builders to bend the sheets at the lap so that a straight line on straight sheets, or a curved one on circular sheets would pass without defection at the lap, through the center of the thickness of the sheet, in this way putting the lap in the position it would try to assume under strain.

Incidentally there is another defect in the lap joint that increases the inherent one, and is due to the flattening of

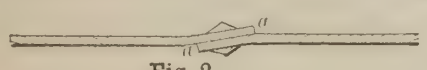


Fig. 2

the circular sheets at the ends, and caused by the difficulty of bending the ends of the sheets under the rolls, and the indifference of the workmen who rely upon bringing the lap together with bolts, and hammering the sheets down when doing so. This flatness, when it exists, and it often does in circular sheets, increases the tendency of the lap to assume the shape described.

Advocates of the lap joint deny that there is any injury done the sheets by the tendency of the lap to assume the shape shown, holding that the motion, if any, is but very slight. That is just where the trouble is. Were the pressure and the resulting movement sufficient to bend the joint to its proper position, then the strain would produce no further movement; while as it is, the motion or movement of the sheet is within the elasticity of the metal and as many as the variations in the pressure in the boiler. This constant movement in time causes a slight injury to the sheet, and then the water gets in its fine and ceaseless work, and it is all, "perhaps," what the result will be.

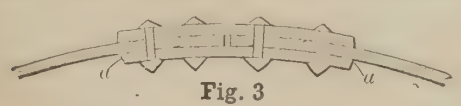


Fig. 3

The second method of joining the sheets, and one now quite common, is to add a welt to the lap joint and, as you remarked in the editorial in the May number of the National Car and Locomotive Builder, adds but little to the strength of the lap joint. It certainly adds to the strength of the rivets by putting the resistance to double shear upon them. It will also stiffen the lap and add to its resistance to buckling or bending when under a strain; but against that, in circular sheets, on account of the form of the welt and the care required to make it conform to the circle of the sheet is the liability of the welt to flatten the sheet on each side of the lap, when this occurs the increased flattened area increases the power at the lap to assume a circular form and that may overcome the stiffness added to the lap by the welt.

Those who use this form of joint lay great stress on the fact that it reinforces the sheet between rivet holes. To a certain extent this is true; but when it is considered how easily a sheet will give at a bend and the sharpness of the bend made in the welt, the gain is slight, but one that might be greatly increased by making the bend longer.

The third method and the one now generally used in Europe is the butt joint with inside and outside welts. This form of joint has everything to commend it. The ends of the sheet butting keep it within the line of strain and entirely removes any tendency to bend and cause furrowing, and allows a due proportion between the strength of the rivets and sheets to be maintained without fear of leaking seams, puts the resistance to a double shear upon the rivets and, with one way of making the outside welt, reinforces the sheet.

There are two methods of making the butt joint; one is to make the welts of equal width, as shown in Fig. 3. This form does away with the inherent defects of the lap joint, and strengthens the rivets, but does not reinforce the sheets, and has the defect that, if the sheets are not in a true circle at the ends, which is very liable to be the case, with the tendency to assume a circle under pressure, any movement of the sheet will be concentrated at *a*.

The other method of making the joint is to make the inside welt wider than the outside one, with an additional row of rivets, as shown in Fig. 4, and appeals to mechanics as the only one now in use that applies to all defects of a riveted union of the sheets. Like the joints with the welts of equal width, it strengthens the rivets and keeps the sheets in line, and, in addition to that, the inside welt re-

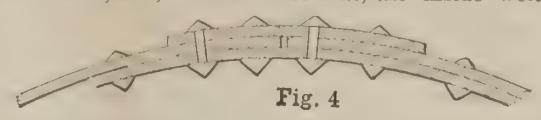


Fig. 4

moves any defects there may be in the abrupt line between the single and triple thicknesses of the sheets, and distributes any movement of the sheets over an extended area. The additional rivets through the sheet and inside welt, if made of greater pitch than those at the joint, add to the strength of the sheet—that of the inside welt.

Those who only look at the work of making a joint, and the ease with which a drift pin overcomes any defects in the rivet holes meeting when the sheets are together, object to the work of making the butt joint. But the days of high pressure and large diameter demand that safety be considered before economy. Plate planes and improved rolls have removed the difficulty of making the sheets of a butt joint meet, and the excuse of expense and difficulty of making a thoroughly reliable seam.

Unfortunately, defects in the joints of boiler sheets do not develop until after, perhaps, years of service, and then with a suddenness that precludes remedy, although, like a recent boiler explosion in the Eastern States, it may teach a lesson that will enable us to find the same defects in other boilers and avoid disaster. And the lesson learned in the case mentioned is one that should forever exclude lap joints from boiler construction. J. D. C.

Ten-Wheel Locomotives for Passenger Service.

We have received from Mr. Theo. N. Ely, general superintendent of motive power of the Pennsylvania Railroad, the following interesting letter in answer to one asking for information as to his experience with ten-wheel engines for heavy passenger trains :

It is pretty late to answer your letter of April 8 in regard to ten-wheel locomotives for passenger service, but as we have nothing definite to contribute to the subject, or no facts that will give you better information than you now have, I presume the delay will not inconvenience you.

The subject is a very comprehensive one, and I think it will be a long time, if ever, before it can be clearly shown whether ten-wheel passenger engines are more economical or the contrary, than eight-wheel.

As regards the performance of such locomotives in passenger service we have no regular experience except on some branches where these engines have been used in mixed service, but reasoning from well-known data I would say that so long as the train to be hauled and the grades to be overcome are such that enough adhesion can be obtained with a single pair of drivers with the other wheels not connected with these drivers, this type of engine is the most economical and will give the best mechanical results.

As trains increase and more adhesion is required for increased traction, the limit of the weight upon one pair of wheels which can be borne by the track is soon reached, and we arrive at the necessity of carrying the load upon an additional pair of drivers in order that the track may be spared without losing the necessary adhesion and traction; but, by doing so, the engine is not so good mechanically, nor is it so economical as it was before.

This has been well proven, not only in England but elsewhere, that the old single driver engines, which were used in the days of light trains, were by far the most economical, and since it has been possible to obtain adhesion by artificial means, that is by continuous sanding in exceedingly small quantities, some English railroads have come back to the single driver type in order to obtain the desired economy and simplicity of design.

The same reasoning carried out further would of course show that, in the passenger service at least, the increase of the number of driving wheels diminishes the economy of the machine.

As said before, we have no data in this office to prove such, and I do not know that any direct experiments have been made to ascertain the facts in the case.

The New York Division has frequently run fast freight trains with class "P" engines and "A" anthracite engines (eight wheels), but this is generally done with engines that are not in fit condition for passenger service, and is done shortly before they are to go into shop, so that it would not be fair to compare them with class "D" and "E" engines (ten wheels); and besides this we have no engines of the two classes which compare in tractive power.

I have often seen it stated that railroads which have adopted 10-wheel engines for heavy passenger trains have obtained very considerable economy from the use of these engines, but I question very much whether this experience has not been somewhat delusive and not attributable to the simple matter of adding more drivers, but far more to the fact that with more drivers and more adhesion required they have found it convenient and even necessary to use very much larger boilers, and that, consequently, the steam generation has been much easier on the boiler, and the economy gained in this way.

Our own experience in other engines has proved that retaining the diameter of cylinders and diameter of wheels, the economy of the engine and its capacity for doing work have been very much increased by increasing the boiler.

Why Will a Car Truck Not Carry a Tender ?

A correspondent writes us: I am a zealous but consistent advocate of uniformity in all sorts of railroad machinery, and I know it pays to make every article interchangeable with others performing the same or similar duties. When we have got freight cars whose trucks carry loads as heavy as those carried by the trucks of tenders, I am in favor of using one truck for all purposes. The advantages of having the same truck for cars and tenders are so self-evident to every railroad man that need not enumerate them. With faith in the soundness of my convictions I have been using my standard car truck under tenders, but with no success worth mentioning. To tell the truth, the attempt is very much of a failure. A truck that carries a freight car over all sorts of track without signs of failure cannot be kept in running order under a tender that makes a lighter load. Now, I want to know your opinion how this comes about.

Answer.—We have repeatedly found that a car truck would not carry a tender satisfactorily, but we are by no means certain as to the cause of failure. We think that the irregular pressure of the load of tenders due to the lashing of the water may increase the stress on the trucks. Then the tender is always loaded while a car does a great deal of its running empty, which may account for the difference. We cannot think of any other way of accounting for the difficulty in making a car truck carry a tender. We are, however, by no means impressed with the advantage of using car trucks under tenders unless they are more elastic than the average car truck.—Editor.

New England Railroad Club.

The members of the New England Railroad Club opened their new season of work by a social meeting or "ladies' night" in the United States Hotel, Boston. The deliberations were ably presided over by President Richards, who introduced the meeting to the discussion of a good dinner as the first business of the evening. After dinner the entertainment took the form of a conversazione, interspersed by short speeches, dramatic fragments and music. Most of those who were present were ready to declare at stopping time that they had seldom enjoyed such a delightful evening. The Alpha Mandolin and Guitar Club delighted the audience with their music, but the most decided musical attraction of the evening was Miss Butler, daughter of Mr. L. M. Butler, master mechanic of New York, Providence & Boston Railroad. Competent judges declared the young lady to be the sweetest violin player they had ever listened to. Mr. E. H. Frye gave some highly amusing and humorous stories and sketches, and by no means the least interesting feature of the entertainment was an exhibition of Edison's phonograph, which gave out several musical pieces and speeches.

The Exquisite Brother of Coal.

The keystone of our order of perfectibility is the crystal of a substance far more intimately connected with our animal life than either silicon or aluminum. It is the crystal of pure carbon—the hardest and brightest gem we know—and it is noticeable that it is one of the few minerals which are not compounds of oxygen. When carbon does combine with oxygen, it becomes something more beautiful than any mineral—a living flame of fire. In everything that, as we say, "lives" upon the earth, emanating from everything that is dying, there is carbon. The remains, made up of lime and carbon, of countless myriads of creatures which once had sense and motion, rise out of their ocean grave as hills and cliffs and we call them chalk. And the chalk mountains in their turn are fired again, and become crystal line, and are quarried on Paros and on the hillsides of Attica and Umbria, and take form under the sculptor's chisel as a Venus of Milo, or a Hermes or a Faun. Carbon is in lime stone and chalk and marble.

It is the forest tree, or the oil we burn; it is the penci with which we write, and pearls are mere carbonate of lime But pure carbon, built up no one knows how, on some tiniest framework of silica, is at last the diamond It is all, we had nearly said, "a matter of form." Bu what is that marvelous putting on of shape aud symmetry? That impulse which determines blind atoms to build that wonder which we call a crystal has never yet been searched out, hardly investigated at all.

We have received from C. L. Rogers, Milton, Pa., a board measure table, which enables one to figure with absolute accuracy and very little labor the number of feet board measure in any stick of timber, and do it at a glance. This table will be found of great service by master car builders, foremen and others having to ascertain board measurements, and we can cordially recommend its use.

Fire-Box and Boiler Construction.

At the September meeting of the Northwestern Railway Club Mr. J O. Pattee was in the chair, and the principal business was the reading of a paper on the above subject by Mr. W. McIntosh, of the Chicago & Northwestern Railway.

The following is a slightly condensed copy of the paper:

RESISTANCE OF THE EXISTING FORM.

The locomotive boiler in common use at the present time, has retained the same general form for nearly half a century, which goes to prove that it was well conceived at the beginning, and difficult of improvement within the limits allowable. Attempts have been made to better its steam-generating capacity by the introduction of water-legs, combustion chambers, circulating-pipes and other devices, but no marked advancement has been made which does not carry with it some objectionable features that offset the advantages gained, and which could have been more fully realized by allowing the boilers to retain their most simple shape, and building them larger, so that instead of being restricted in steam-producing capacity and water circulating spaces, they would have had a margin in excess of requirements in the first respect and as ample water circulation as is possible to obtain.

FORMS OF FIRE-BOXES.

Locomotive builders who keep abreast of the times recognize this fact and are constructing larger boilers with wider fire-boxes resting on top of the frames instead of the narrow box between them, thus increasing grate surface and surrounding water space. Radial stays connecting the wagon-top and crown sheet, are being used to a considerable degree, replacing the cumbersome crown-bars. When the radius of these two parts properly conform, good results are obtained from this method of staying; but when there is a marked difference in this radius (as must exist in small boilers) the utility of the crown stays is greatly reduced, and the margin of safety much less than with crown bars.

The Wootten fire-box is designed to obviate this difficulty by making the crown sheet and wagon-top as nearly as possible of the same radius, but great opposition is encountered by reason of the stays leaking and breaking. A short time since I noticed some engines of this class running between Laramie and Rawlins on the Union Pacific Railway which had the lagging removed from the wagon-top, owing to the stay bolts having to be renewed at such frequent intervals that it was useless trying to keep on the jacket.

The Belpaire type of boiler now coming into extensive use on the Pennsylvania and Burlington systems, is without doubt one of the best of modern forms. The wagon-top and crown sheet being on the same plane, permits direct stays to be used in every direction, thus giving the maximum of strength with the minimum of bracing. The principal difficulty with this kind has been the trouble experienced in connecting the forward corners of the wagon-top with the cylindrical part of the boiler. But this has been largely overcome by the use of proper forms upon which to shape the sheets.

THE STRONG BOILER.

Another boiler that but recently came into prominence and has scarcely passed the experimental stage, although enough has been learned of its merits to warrant the prediction that it has come to stay, and will likely displace the present standard, is the Strong—constructed on the best possible lines to embrace strength. Its double fire-box centering in a combustion chamber admits of greatly improved combustion while its corrugated tubular furnaces surrounded by an ample water-space, should reduce the damage from incrustation to the minimum. And the entire absence of stay bolts and riveted seams exposed to the fire, ought to prolong its life far beyond the limits of those in use to-day, thereby increasing the general efficiency of the locomotive; for I venture to say that where bad feed-water is used, fully three-fourths of the expense of maintaining motive power is caused either directly or indirectly by fire-box and boiler repairs and renewals. There is also another admirable feature about the Strong locomotive, and that is the accessibility of all portions of boiler and running gear, and the ease with which repairs can be made compared to the ordinary machine, which requires the removal of the whole framework to renew any of the firebox sheets.

MATERIAL FOR BOILERS.

In the United States steel is now used exclusively in modern boiler construction, and as the tendency is to build larger boilers and carry a higher pressure of steam, great care should be taken to select material with sufficient margin of strength, and to have the work performed in a most thorough manner. A careful system of inspection (particularly of stay bolts and braces) should be enforced, otherwise a boiler built in the best possible manner is liable to become dangerously weak.

As regards the best thickness of metal for ordinary fire-box sheets, there can be no rule laid down for general use. Three-eighths inch and not ½ inch sheets may be used successfully in localities where the feed water is good, and thinner ones give better results where bad water is the rule. On the lines that I am connected with water is generally bad for boiler use, and we obtain the best service from ⅜-inch back flue and crown sheets and $\frac{5}{16}$-inch side and door sheets, and naturally conclude that the thinner the sheet between the water and the fire the less liability there is for the metal to crack.

In the discussion that followed the reading of the paper the only point of interest was made by Mr. Warren, who had seen it stated that out of 12 boilers which exploded within the year, five of them had the crown sheet supported by radial stays.

We doubt the accuracy of this statement.

To Preserve Timber.

The following is the principal part of a paper on the preservation of wooden cross ties, read by Mr. W. W. Reed at the annual convention of the Roadmasters' Association, held at Detroit last month:

The gradual destruction of timber by decay is ascribed by Liebig to a slow combustion by oxidation. Pasteur ascribes decay to the action of living germs in the atmosphere. Prof. Tyndall supported Pasteur's views by a series of experiments, in which he found that, by placing destructible materials in a tube and excluding the air, putrefaction ceased indefinitely, or until the material was again exposed to the atmosphere. It has been determined by repeated experiments that a thorough preservative of timber must not only possess chemical antiseptics for the coagulation of albumen, and power as an insecticide, but must also possess the mechanical property of the exclusion of the atmosphere by filling the pores and surrounding the fibers with a substance impenetrable by the atmosphere. The atmospheric germ theory finds additional support in the fact that timber constantly under water does not decay; that timber which is constantly dry decays slowly, due probably to coagulation of the albumen; that timber thoroughly seasoned by heat decays less rapidly than if treated by any other mechanical means; and that timber subject to alternate dryness and moisture decays most rapidly, owing doubtless to the repeated softening of the albuminous substances of the timber.

A variety of remedies for premature decay of timber were mentioned, but the author favored above all others the creosoting process.

While creosoting is the most perfect it is the most expensive process; and a modification of the process which will reduce the cost is very desirable. This we believe may be done for cross ties by first treating them with chloride of zinc (Burnettizing), which seeks the center of the timber, and then injecting creosote as an outer protection. By this means a valuable result will be obtained at a minimum cost. The creosote will overcome the tendency of the chloride of zinc to wash out or volatilize, and will also neutralize the tendency of the timber to surface crack, as when the zinc alone is used, while the zinc will thoroughly protect the interior of the timber. Just how much the cost of creosoting can be reduced by this process only actual experiment can determine. It has been shown that Burnettized timber rots first on the outside and creosoted wood decays first on the inside. Thus the combination should be more perfect than either alone.

Many processes of applying preservative agents have been resorted to, from the ordinary paint brush, through the various stages of steeping, vital suction and application by hydraulic pressure, to the more perfect process of exhaust and pressure within a closed cylinder. This latter method excludes sulphate of copper and corrosive sublimate, as these have a deleterious effect upon iron. Chloride of zinc and creosote may be applied in a closed cylinder successfully and to that method we will refer more particularly.

The machinery consists essentially of an iron cylinder with a door at one or both ends, and a track running into or through it to facilitate the handling of the timber. The doors may be closed air tight, and the cylinder is connected with a tank holding the creosote or other preservative, and with the pressure pumps. After the timber is placed inside the doors are closed tight and the air first exhausted and the sap drawn off. The creosote or other preservative is then admitted, and finally a pressure is applied to force the oil into the timber. This is the process in its simplicity and it is improved upon in various ways. By steaming the wood three objects are attained: First, the pores are more thoroughly opened and the sap withdrawn more completely; second, the fibres are protected against the destructive action of the high temperature of the creosote oil admitted, which temperature is essential to thorough saturation, as creosote is exceedingly sluggish and will not enter the wood to any extent when its temperature is under 125 degrees F.; and third, the steaming coagulates the albumen. The steaming is also valuable in the case of the sulphate of zinc, but the heating of the zinc is unnecessary and undesirable. Another method of treating timber is to char it in closed cylinders, and this method is patented and on trial. It possesses the merits of coagulating the albumen quickly and of placing another exterior barrier against destruction, as it is well known that charring the outside of timber will materially increase its life. This method is not to be recommended, however, as the steaming process seems to possess all the merits of simplicity and efficiency.

While we have not undertaken to state in detail all the many points essential to the thorough execution of any of the processes noted, we have presented a fair and accurate outline that will serve as a guide or starting point for future investigation.

A Wood Carving Machine.

The Goehring geometrical wood carving machine now on exhibition in the Chicago Exposition attracts a great deal of attention, and is considered one of the most wonderful machines invented for wood working purposes. The *Lumber Trade Journal*, in describing the performance of the machine, says:

"It is a massive affair, yet so simple withal that it can be managed by any operator of an ordinary planer. It is well built, and perfect in every detail, giving ample evidence that its inventor has not spent the last 15 years in vain. Notwithstanding the heaviness and strength of the machine, it can be operated at the rate of 30 feet a minute with the same power required in running an ordinary molding machine, even when turning out the most intricate patterns. It can be run on plain surfacing or straight molding if desired but one operation is sufficient for ornamenting the surface; and putting on an overlapping bead in addition. A feature of the machine is a hydraulic pressure up to 32.000 pounds, which can be adjusted according to the character of the stuff that is being worked. By this means the toughest and knottiest specimens of hard wood can be worked as indicated above, and show as clean and smooth a surface as any soft wood. The board is held flat on the table, and cannot get out of the desired position. Another feature of the machine is a universal eccentric cam which is susceptible of 760 changes. Nine of the machines have been made, and arrangements have been made for turning them out as fast as wanted. "If I were 10 years younger," said the inventor, "I would not sell a machine, but would place the manufactured product on the market in every city where lumber is sold." The merits of the product need but to be seen to be appreciated, and no woodworking establishment that makes a specialty of fine interior finish will hereafter be considered complete without at least one machine to turn the beautiful carved material that is so rapidly and so easily made by these machines. Another feature which is to be added later is a combination lathe, to turn carved circular work from one inch to four feet in diameter."

Favors the Luttgens Damper.

An inquiry having been made through the *Locomotive Engineers' Journal* regarding the value of the Luttgens variable exhaust damper, two engineers running out of Memphis, Tenn., sent jointly a letter to the journal in which they say:

"We have been using the Luttgens variable exhaust damper for the past two years, and with the very best of success, as a protection against fire. The road by which we are employed is through a cotton country, and during the season the cotton is exposed at all stations, and we have never had a case of fire since its adoption and use. Many of the stations are on very heavy grades, and with the success we have had in passing exposed cotton think it speaks exceptionally well for the damper. We think if the rod regulating it from the cab was put on left side in place of right, so the fireman could have control of it, it could be used to greater advantage and add a great saving in flues and fuel."

The Plug Engineer.

When Angus Sinclair first struck a job on a prairie road in Iowa, he was put to stopping and starting an old scrap-heap on a branch—in local railroad parlance called "the plug run."

It was not long before the townspeople got the fever from the boys and called it the "plug run." Then the boys abbreviated it to "the plug," and everybody followed. Sinclair was known only as "the engineer of the plug," as were also the other trainmen, each according to his station.

One Sunday evening, our friend Sinclair was out with a party of young people taking in the town—had his best girl along—and they strayed into a church where the colored people were having a revival.

The party of young folks sat quietly in the back seats eating peanuts, until at last the hat was passed; it went around and came back to the earnest old exhorter in charge with but a few sorry pennies, which he emptied on the pulpit, and, leaning over the altar of hope, handed the hat back to one of the deacons, saying, "We has to hab a little mo' dan dat, pass it agin, an' don't forgit de white brudders in de back ro', prehaps da gib sumting."

Again the hat came around, and the embryo secretary of the Master Mechanics' Association chipped in a quarter.

When the hat got back to the front, the old dominie picked the quarter out from among the pennies, and holding it up between his thumb and finger said:

"De engineer ob de plug gibs a quarter; Lord bress de engineer ob de plug!"—*Locomotive Engineer.*

Mr. J. Hackworth Young, general foreman of the Chicago, Milwaukee & St. Paul shops, at Western avenue, Chicago, writes to the editor of this paper as follows:

"I notice in your valuable book on 'Locomotive Engine Running and Management,' that you attribute the 'invention' of the side rod to Geo. Stephenson (p. 179).

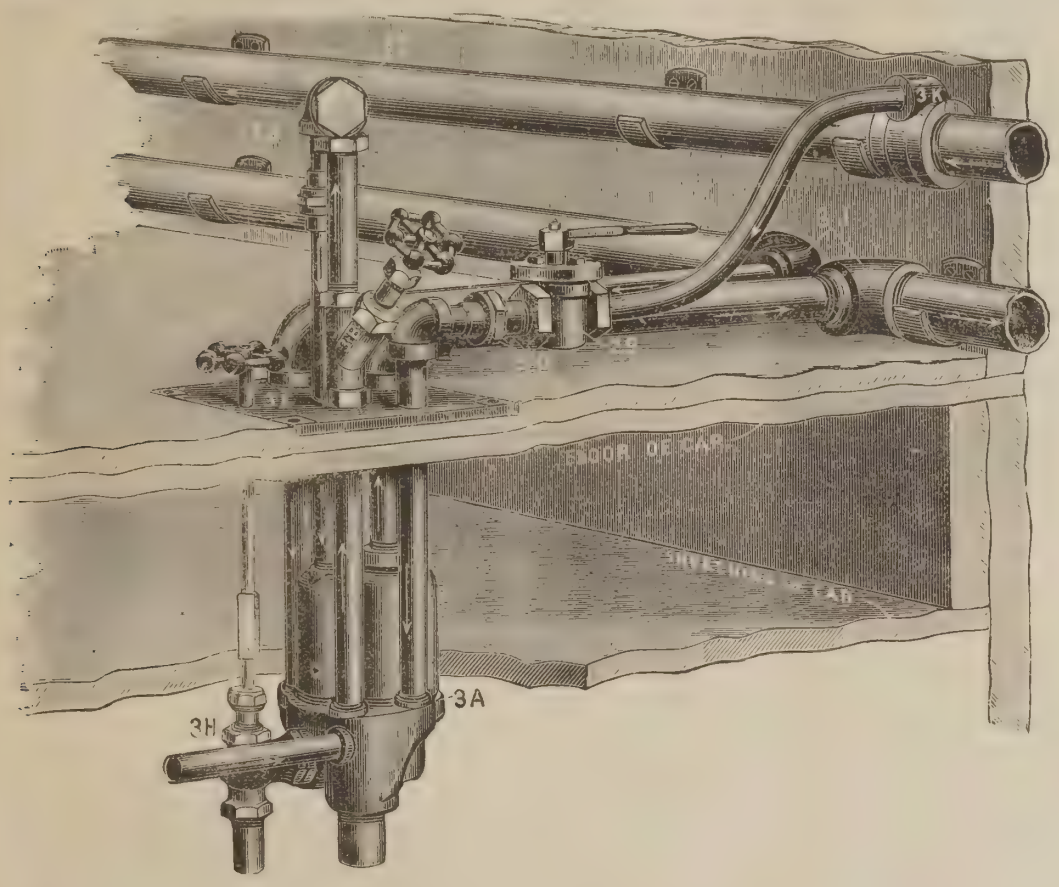
"The side rod, or 'coupling rod,' as it is more correctly called in England, was designed, invented and first used by Timothy Hackworth in his engine, the 'Globe,' built, I believe, in 1828, at Shildon. I refer you to Zerah Colbourn's 'History of the Locomotive.' I am afraid you have been reading Mr. Samuel Smiles' story books."

Towards the end of August some tests were made on the New Jersey & New York Railroad, near New York, with a train of six cars fitted with a brake manufactured and controlled by the New York Air Brake Company. The brake is interchangeable with the Westinghouse, and works in much the same way. The tests consisted of service and emergency stops, and were entirely satisfactory. Several tests were also made by using the conductor's valve.

Commingler System of Car Heating.

The annexed engraving shows the principal apparatus belonging to the commingler storage system of car heating lately perfected by the Consolidated Car Heating Company. Each side of the car is piped independently of the other, and the apparatus shown in our illustration is in correct position for one side of the car, and is duplicated for the other side Connection is made with the train pipe by means of a short horizontal pipe shown at the bottom of the apparatus. Through this the steam enters, and passes up through the nearest vertical pipe in which is placed the valve 3 *B* above the floor for shutting off the steam when desired. When this valve is open the steam continues to the highest point of this upright pipe, and returns through the parallel downflow pipe into the commingler below. This commingler is constructed on exactly the same principle as the regular McElroy commingler. The incoming steam is divided into a large number of small streams before coming in contact with the water by passing through coarse gravel or pebbles. This prevents the noise or pounding which occurs when steam and water unite in large streams.

neat and ornamental casing, which is about 6 inches in diameter, and is intended to be secured to the side of the car at the most advantageous point for obtaining the average temperature of the interior of the car. On the face of the casing a thermometer is placed. The regulator itself consists of a thin metallic diaphragm in which is confined a fluid which is exceedingly sensitive to a change of temperature above 68 degrees. At this temperature it vaporizes, and as a gas it exerts considerable pressure upon the diaphragm, and the area of the latter is such that the pressure exerted per square inch is sufficient to close a valve which regulates the steam supply to the heating apparatus. The diaphragm operates upon a series of levers ingeniously arranged in a very compact form, by means of which the motion is transferred to a vertical rod which passes from the regulator down the side of the car and through the floor to the steam valve. The vertical rod is protected from injury or interference by being encased in a suitable pipe of small dimensions. It will be readily seen that the employment of a fluid which will vaporize at the required temperature gives a much more reliable and effective regulator than when expansion without evaporation is depended upon, for the steam



The steam passes out of the commingler through the nearer of the two circulating pipes, and passes through the entire series of piping on that side of the car, returning through the circulating pipe 3 *E*, which is shown in the rear in our cut. This circulating pipe enters the base of the commingler, and the internal arrangement is such that it can either pass through the circulating pipes again or can be discharged by opening the angle valve 3 *H* at the bottom of the commingler by means of a handle 3 *F* above the car floor. It is at once evident that if this valve is opened far enough to allow all the water of condensation to pass out, the circulating pipes will be filled with steam all the time. If, however, this valve is closed, the water will back up in the pipes and the whole circulating system soon be filled with this water obtained by condensation. The steam entering the commingler then reheats it and keeps it in circulation. When working in this manner the water of condensation continues to form as the steam enters, and must have some outlet. This is obtained by attaching an overflow pipe 3 *K* to the highest point in the circulating system. This pipe is shown in our engraving, and will be seen to be fitted with a valve, 29, located above the car floor, where it can be easily reached. When this valve is opened, the overflow will pass through it, down into the base of the commingler at 3 *A*, and out through the short pipe, as indicated by the arrow line. This water which passes through the overflow does not again enter the commingler proper, but simply passes through the casting in such close proximity to the incoming steam that any possibility of freezing up is entirely avoided.

The advantages of this system will be readily appreciated. When it is desired to heat a car quickly the overflow valve is closed, the steam valve opened, and the angle valve at the base of the commingler opened far enough to allow the air and water of condensation to pass out. The car is then being heated by direct steam in all the circulating pipes. This will heat the car very quickly, and when the desired temperature has been reached and heat is not required at the same rapid rate as at first, the valve through which the water of condensation is passing can be closed and the overflow valve opened. The water of condensation will then remain in the pipes until they are filled, when it will flow out in the manner previously explained, and the system will then be working as a hot water circulation. When the car is to be cut off from the engine for a number of hours, the hot water can be allowed to remain in the pipes, and they will keep the car moderately warm for some time. If the car is to be stood in the yard for an indefinite period, the angle valve at the bottom of the commingler is opened, and every drop of water will pass out of the pipe, air to take its place entering through the overflow.

Another very important device lately perfected by the company is their automatic temperature regulator, by the use of which the temperature of a car can be maintained between 68 and 72 degrees. This regulator is inclosed in a valve can have an opening the required extent, which will be maintained without any reduction whatever until the required temperature is reached, when the vaporization of the fluid will cause a positive motion of considerable magnitude, thus entirely obviating the gradual throttling of the steam, as the temperature at which it is desired to keep the car is reached. The valve is entirely closed by the time a temperature of 72 degrees is reached, and if the car cools off to 68 degrees the valve is again opened by the condensation of the gas in the diaphragm.

The De-Oxidized Metal Co., of Bridgeport, Conn., have recently added another building to their already large foundry, so as to enable them to keep pace with the orders they are constantly receiving for their metal. Mr. W. W. Keys has recently taken out a patent for a new process of de-oxidizing copper.

The Adams & Westlake Co., Chicago, have published a new illustrated catalogue showing by the use of good wood cuts the many forms of lamps and signals manufactured by the company. The catalogue also contains the uniform train rules and rules for the movement of trains by telegraphic orders adopted by the General Time Convention.

The Ajax Metal Company, of Philadelphia, Pa., have perfected their process for coating all kinds of metallic substances with lead, thereby making them rust proof. They exhibit at their office a number of articles coated with lead that have been exposed to the weather and immersed in acids, that do not show any change, either from the action of the weather or the acids. Some shingle nails, so treated, placed side by side with galvanized nails and exposed for a long time, show no appreciable change, while the galvanized nails show signs of rust. Several railroad companies recognizing the value of this process have given them large orders for roofing iron and other articles. They are running their works night and day and find it difficult to keep up with their orders.

The city of Boston recently contracted with the Tripp Manufacturing Company for their anti-friction journal bearings for the equipment of the large Federal street drawbridge, which is being re-built at great expense. Undoubtedly the same bearings will be placed under the various street bridges of that city at an early date.

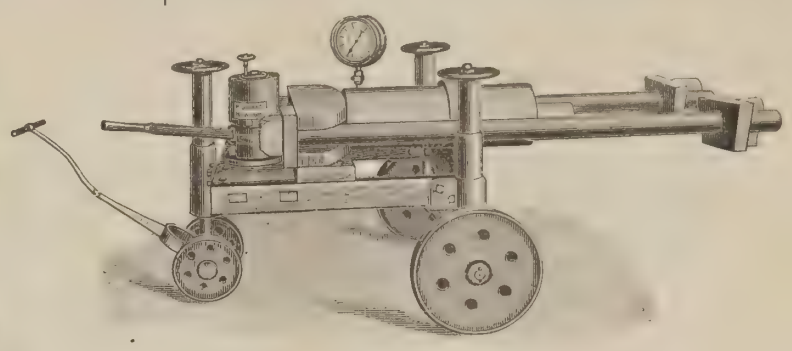
This company are now represented in the West by Samuel A. Randall, superintendent, who is on a business trip to Chicago and other Western cities, and Martin J. Deviney, salesman, who is on the Pacific Coast, where many large orders are being secured. They are the sole manufacturers of the Tripp metallic packing, which has been adopted by leading corporations of New England and the Middle States; are now shipping to customers in Canada and Great Britain, where a large business is assured.

Dudgeon's Hydraulic Press.

This cut represents a portable horizontal hydraulic press for pressing in crank pins of locomotives and engines or for removing the same, also for pressing on and off small car wheels.

It is hung upon three screws mounted on large wheels, stands 21 inches from the ground to the center of ram and has a vertical adjustment from that to 33 inches, this will accommodate it to any unevenness of ground or varying heights of work without blocking, etc.

It has two pumps, one small and one large; both work by the same lever at the same time and by one man. When speed is required both are used giving a movement to the ram of one-sixth of an inch per stroke and a pressure of about 10 tons. When the full capacity is required the large pump is opened by means of the wheel *A* and only the small one used. To return the ram after pressing, the valve is opened by depressing the lever (same as in the ordinary hydraulic jack) it will then return itself, being forced back by means of a heavy spiral spring within the cylinder, thus saving much time and labor in prying it back as was formerly done



The component parts are made of the following materials Forged steel cylinder, ram, side rods and yoke, wrought iron washers, and elevating screws which work in steel nuts; steel pumps with hardened steel pistons which come in contact with packing only, thus reducing the chances of wear or damage to that most vital part of all hydraulic appliances. It is built with the utmost exactness and care in every detail, with sufficient strength to withstand the strain, but without superfluous material to increase the weight unnecessarily. It is acknowledged by all who use it to be by far the best machine in the market for the purpose.

This highly useful tool, which ought to be in every locomotive shop, is manufactured by Richard Dodgeon, 24 Columbia street, New York.

The Egan Company, Cincinnati, send us notice that their new triple drum sander for the polishing of all kinds of wood is proving a great success. The seasonable advice is "try one and prove its merits."

The Yale & Towne Manufacturing Company have put on the market a new screw "sash fast" which is reported to have the following advantages: It cannot be opened from the outside of the window. By the diagonal action of the screw the sashes are drawn firmly together, and also forced tightly against the top and bottom of the window frame, thus preventing all rattling. It is strong and well proportioned. It is neat and mechanical in appearance.

The Wood Extensible Air Car Step Company, of Wilmington, Del., have arranged with quite a number of railroad companies to place the step on their passenger cars; among them the Lehigh Valley, Wilmington & Northern, Central of Georgia, etc. A number of other roads are experimenting with it, and whenever used it has proved successful, and is generally appreciated by the public. The exhibition car that is going all over the country showing California exhibits and called "California on Wheels," is equipped with this step, and as there is always a constant stream of people going in and out of this car, while on exhibition, it is a strong test of its strength and durability.

The business of Mr. James Spear, of Philadelphia, Pa., who for so many years has manufactured stoves for heating and ventilating railway cars, has been succeeded by the James Spear Stove & Heating Co., Mr. Spear being president and J. M. Hazel secretary and treasurer, with office at 1014 and 1016 Market street, Philadelphia. They have received a number of orders this season for their stoves, not only from railroad companies that still adhere to that system of heating cars, but from those who are experimenting with heating by steam, using the stove as an independent heater. These stoves have been in use a long time, and whenever used have given perfect satisfaction. Their orders up to date show an increase of over 20 per cent. over corresponding date of last year.

The American Steel Car Wheel Company sends us particulars of tests their wheels were subjected to in the presence of a party of railroad men and others. A 33-inch car wheel was placed on two solid iron blocks, rim resting on each block. A weight of 525 pounds falling at a height of 17 feet struck the hub 25 times without any effect, except battering the metal. It was then dropped 10 times on the rim without a fracture. Then a weight of 1,400 pounds was tried, falling at a height of 17 feet, struck the wheel 11 times, but failed to break it, showing it to be practically indestructible. At another exhibit, in order to test the expansion and contraction of the metal, a wheel was buried in sand and a charcoal fire built around the tread until it was brought to a red heat. Then it was taken out and exposed to the atmosphere, which had no effect on it whatever. This demonstrates beyond a doubt that the wheel is a perfectly safe one under all circumstances. These wheels are in service on most of the New England roads, as well as New York and Manhattan Elevated Railroad and several Western lines, and are giving universal satisfaction, and in some instances receiving the highest endorsement.

Gold's Pressure Regulator.

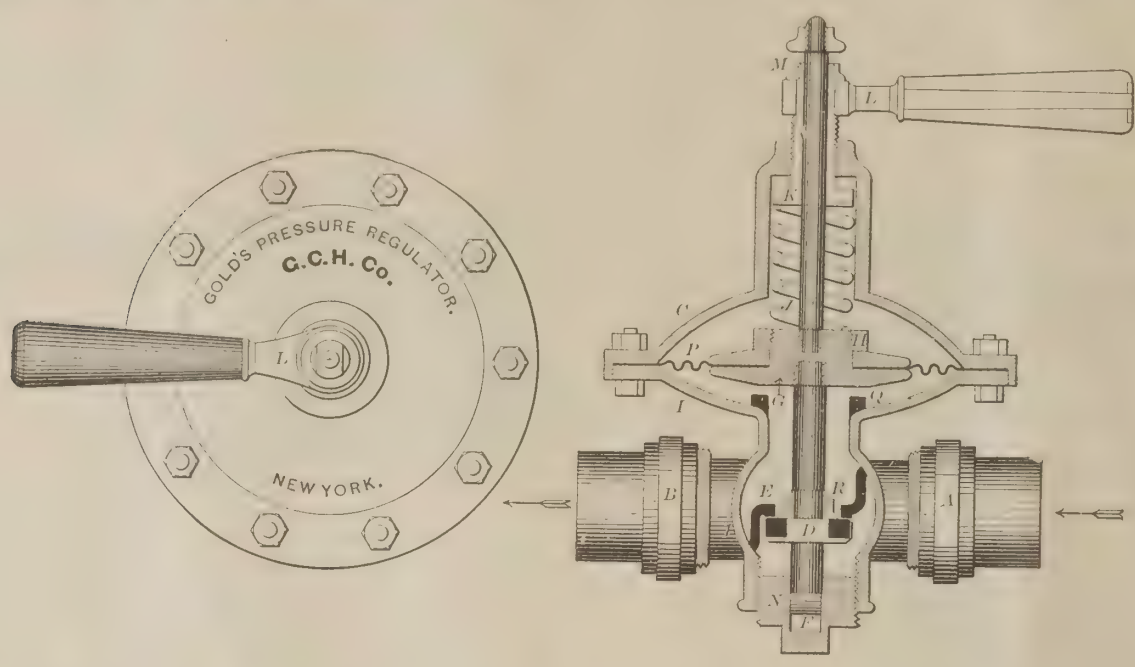
The necessity for accurate and absolute regulation of the delivery of steam from locomotives to the steam pipes on railroad cars and further from the steam pipes to the cars are points of the first importance attaching to the science of heating cars by steam.

Gold's pressure regulator or reducing valve, here illustrated, is the practical issue of a series of careful experiments and tests extending over several winters and a continual observation of the requirements of the case made by the inventor.

The cut shows the regulator in section. The valve body *I* is made specially strong and of the very best metal, and has a regular valve seat *E* and an inlet and outlet for steam at *A* and *B*.

The disk seat is a composition asbestos one fitted into the cup on spindle *N*, and is held in place by the nut *R*.

To fit in a new disk seat it is simply necessary to remove



the plug *N*, and unscrew the spindle *D* from the lower diaphragm flange *G*.

The diaphragm is made of best phosphor bronze corrugated slightly; this insures the necessary flexibility and reduces the strain which is on the diaphragm and enables it to stand a very high pressure.

It is bolted around between the valve body castings and the hood or cap, and is held in place by the male and female flanges *G;* these flanges are held firm by the he xagon nut *H* screwed on to the thread of the male flange.

The upper part of the spindle is screwed into this hexagon nut, and passes out through the cap and the hollo w screw *K*, it is independent of the handle *L* until the valve is required to be shut entirely, when by turning the handle to the left it carries the spindle up with it, and brings the valve disk to its seat.

The cast steel spring *J* is wound around this upper spindle, and is operated by the lever handle to withstand such steam pressure as may be required to produce the necessary delivery pressure. By turning the lever to the right the hollow screw *K* to which it is fitted will bear the spring down on the diaphragm, and keep the valve well open to allow a high pressure to pass through the valve; by turning to the left the pressure of the spring is taken from the diaphragm, and will allow of its raising the valve seat, as the boiler pressure enters and delivers only such lower pressure as may be required.

The utmost limit of the movement of the valve may be seen thus; the diaphram cannot be forced by the spring to a point below the lugs or diaphram stop *Q*, which are cast in the steam chamber of the valve, nor can it be moved by the lever higher than to bring the disk to its seat and close the valve. This movement is one quarter of an inch.

The hood or cap which covers the diaphragm prevents at any time the cab of a locomotive from being filled with steam, should the diaphragm through any cause break or leak.

The steel spring, being in the hood, does not come into direct contact with the steam, which tends to corrode it and weaken its tension, as in the case where the spring is placed in the steam chamber.

The principle of the working of the valve is equilibrium of opposing forces.

For instance, if the steam from the boiler enters the valve and strikes the diaphragm at a pressure of 150 degrees, and a delivery pressure on the steam pipe and into the cars of only 20 pounds is required, the handle of the valve is turned to the left; the spring now offers no opposition to the diaphragm, which is forced upward by the steam, so far reducing the area of the valve opening until the steam gauge registers the required delivery pressure; if a higher pressure, say to 30 pounds, is now required, the handle is turned to the right and bears the spring down on to the diaphragm, preventing it from rising and closing the valve further than will allow of the higher pressure required.

In this way the pressure of steam delivered to each car may be regulated within a pound or two, and on a large train of cars, if one of these regulators is fitted on each coach, the pressure of steam may be regulated so that the rear car will have the same pressure of steam as the first one, and avoid the nuisance of some cars being overheated while others are cold.

The valve body is fitted with unions ready for connecting. It is manufactured by the Gold Car Heating Company, Frankfort and Cliff streets, New York.

A Self-Lubricating Bearing.

Some years since Mr. P. C. Holmes, of Gardiner, Me., the senior member of the P. C. Holmes Co., manufacturers of water wheels, shafting, etc., and already a practical inventor, turned his attention to the invention of some form of a bearing which should be self-lubricating and at the same time durable.

Realizing also the importance of forsaking, if possible, the use of oil, both on account of the first cost and of the necessity of providing for its constant application, he commenced experimenting with plumbago, a substance long known to mechanics as the best of lubricators, but heretofore practically unavailable by reason of the difficulties in the way of combining or applying it. In the form of separate plugs, driven into metallic boxes it had already been tried, as in the metalline and mineraline bearings, but with the disadvantage that when the plugs had worn down to the surface of the metal, friction was developed, and the bearing became useless as a lubricator.

After long and patient experimentation however, Mr. Holmes invented a combination of plumbago with pulp, which was, after proper treatment, subjected to heavy pressure in moulds, receiving any shape desired and capable of being made as hard as iron; and producing a substance at once hard, light and a self-lubricator throughout its entire structure, with the important advantage of being free from any metallic substance capable of exciting friction.

The past fifteen months have been devoted to experimentation with the bearing under different conditions, and the following are some of the results obtained:

In the spring of 1889 a bearing was placed under one of the main shafts of the factory at Gardiner, and has run constantly in working hours to this day, without having been once removed or changed in any way. No oil nor any lubricant has ever been applied to it, and so far as the most careful inspection and measurement can determine, there has been absolutely no wear. The bearing remains precisely as it was when first placed in position and has never developed any friction nor given the slightest trouble, While at first sight this might seem unreasonable, it is readily explainable when the claim is allowed which is made for this bearing, viz., that comparatively no friction is developed in its use. No friction, no wear. A practical demonstration will be made to any one who will visit Gardiner, where the boxes are in operation, or to those who desire to have the bearings placed in their works for a test.

Bearings have also been tested in factories at Auburn, Me., Waltham, Mass., and at various other places with invariably the same result. In no single instance has there been a failure to more than satisfy every requirement made upon it.

Boxes have also been fitted to carriage axles and have run continuously for the last seven months with perfect satisfaction. One carriage in particular has been driven over 500 miles without any perceptible change in the boxes and without the slightest trouble in any way. As bearings for spindles and shell-rolls in cotton mills, the material has successfully passed through the most exhaustive tests, and full frames of spindles are now being made for use in mills in Lewiston, Me., and Waltham and Lowell, Mass.

As the coming bearing for all railway carriages and engines, the greatest expectations are being entertained for it. Bearings are now being constructed and tested at the Gardiner factory, for use under railway cars, and it is hoped that the public may very soon have a practical demonstration of its successful use.

Further information about this bearing can be obtained from H. S. Dyer, 306 West 124th street, New York.

The Hall Signal System.

The numerous railroad train accidents that have happened during the present season of crowded trains demand that railroad managers should devote more attention to protecting the lives of their patrons by introducing station signals of the kind that will prevent collisions. Those who are considering the question of introducing signals ought to look into the Hall systems, which have been in use on crowded lines long enough to demonstrate their value to railroad companies. The Hall Signal Company, of New York, is now prepared to make and erect its new system of automatic electric signals for spacing trains, for warning travelers at highway crossings, and for protecting switches and other dangerous points; and electric interlocked signals for protecting junctions and grade crossings of two or more railroads. The automatic block signal system of this company is adapted to either double or single track, and embraces well-tried and perfected devices for protecting side tracks located between stations as well as all station switches, drawbridges, and other special points, and intervolved tracks. Signals of this pattern have been in use on the Boston & Albany, and New York, New Haven & Hartford, the New York Central and other leading roads for years, and have given entire satisfaction in every respect.

"John Ericsson's Opinion of Magnolia Metal" is the title of a circular issued by the Magnolia Anti-Friction Metal Company. We have not room for the circulár, which gives interesting particulars about magnolia metal, but we would advise those interested in good bearings to send for it.

A Small Locomotive.

The St. Louis *Globe-Democrat* says that Charles T. Young, a fireman on the Fort Worth road, has a very pretty piece of mechanism on exhibition at his residence. It is a miniature locomotive engine, and is supposed to be the smallest coal-burning locomotive in existence. The length of this little wonder is five feet, and the height 20 inches. Every piece of machinery about it is perfect, and the young man has been working on it for a year whenever he could find time to do so.

It is estimated that had he worked steadily at the job it would have consumed five months. It is called the B. of L. F. No. 10 engine. It weighs 225 pounds with the tender, and is capable of hauling 900 pounds. It runs at a pressure of 75 pounds of steam and can carry 150 pounds. The boiler is 7 inches in diameter and 24 inches long It has a sand box, throttle, reverse lever, dampers to ash pans, water gauge, steam gauge, and everything pertaining to a locomotive. The connecting links are perfect, and it runs backward and forward without any trouble. The boiler is a Grant boiler, and holds three gallons of water. The tank will hold four gallons of water. The sand box contains one-half pint of sand.

One of the smallest things connected with it is the lamp in the head-light. It contains a teaspoonful of oil and will burn an hour. There is also a small lamp in front of the steam gauge. The whistle is a gem. It is a very minute affair, but emits a clear, shrill sound. Each of the driving wheels is 6 inches in diameter, and the stroke wheel 2 inches in diameter.

Gould & Eberhardt, of Newark, N. J., report the present demand for the Eberhardt's patent shapers, drill and tapping machines and entirely automatic gear cutters good, and have recently booked orders for the later machines to Westinghouse Electric Co., Prentiss Bros., F. E. Reed, and a carload is ready for the McGill University, in Canada, besides a number of foreign shipments.

The Frost Dry Carburetor Co. have sent out an illustrated pamphlet showing a variety of tests made to demonstrate the safety of the car heating system controlled by the company. The system is said to be progressing very rapidly into favor with railroad companies and that those who have tried it are highly pleased with the results as an excellent light is secured at a minimum of cost.

Our Directory.

We note the following changes during last month:

Atchison, Topeka & Santa Fe.—Alva Mitchell, formerly foreman of locomotive repairs of the Waukesha, Wis., shops of the Wisconsin Central, has been appointed master mechanic of the Southern Kansas division, succeeding T. D. Volk, resigned. F. A. Burgess, superintendent eastern division Atchison, Topeka & Santa Fe, has resigned. C. T. McLellan succeeds him.

Atlantic & Danville.—C. B. Peck, vice-president and general manager, and C. R. Capron, general freight and passenger agent, have resigned.

Baltimore & Ohio.—J. V. Patton has resigned as superintendent of the Pittsburgh division.

Chicago & Northwestern.—William Smith has been appointed superintendent of motive power.

Chicago, Rock Island & Pacific.—S. B. Hovey has been appointed superintendent of the western division, with headquarters at Colorado Springs.

Columbus & Hocking Valley.—James Bruce has resigned as superintendent of the Toledo division of the Columbus & Hocking Valley & Toledo road.

Eastern Minnesota.—F. A. Merrill has been appointed superintendent.

Houston & Texas.—A. W. Littig has resigned his position as superintendent of the first division of the Houston & Texas Central road on account of ill health. He has been connected with the road in various capacities.

Lake Shore & Michigan Southern.—Albert Bodine, of Elkhart, Ind., has been appointed master mechanic of the Toledo Division, with headquarters at Norwalk.

Louisville, New Albany & Chicago.—L. W. Schafer has been appointed master mechanic of the Second Division, with headquarters at Lafayette, Ind.

Mexican Central.—T. B. Donahoe has been appointed general superintendent of the Tampico Branch of the Mexican Central Railroad, headquarters at Tampico, Mex.

New York, New Haven & Hartford.—Albert S. Ostrander has been appointed superintendent of the Shore Line Division, with office at New Haven, Conn.

Richmond & Danville.—C. F. Thomas has been appointed master mechanic, with office at Alexandria, Va.

Pittsburgh & Western.—Mr. Wm. Truby has been appointed superintendent of this road.

St. Louis, Alton & Springfield.—M. T. Seymour has resigned the position of superintendent.

Union Pacific.—E. McNeill has been appointed general manager of the Pacific Division of the Union Pacific. F. S. Mertsheimer, master mechanic of the Kansas Division of the Union Pacific, has been appointed superintendent of the Wyoming Division. Mr. Mertsheimer has been previously master mechanic of this division.

Winona & Southwestern.—C. L. Stewart has been appointed assistant superintendent. He will have charge of the operation of the road. R. H. Emerson has been appointed master mechanic. He will have charge of locomotives and all rolling stock. Both will have their headquarters at Winona.

Employment.

Wanted.—A Traveling Salesman in railway supply trade is open to an engagement. Wide acquaintance among railroad men. Member of Master Mechanics' Association. Address T. S., care National Car and Locomotive Builder

NATIONAL CAR AND LOCOMOTIVE BUILDER

NOVEMBER, 1890.

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Increase of Subscription Price.

Beginning with the first of next year, the subscription price of the NATIONAL CAR AND LOCOMOTIVE BUILDER will be two dollars a year. A first-class journal of the size and quality we are publishing cannot be produced and sold for less money than the sum named. Ever since the paper was enlarged the subscription price has fallen short of covering publishing expenses, and we only act on sound business principles in asking that our patrons should pay a fair price for what they purchase. We are engaged in making arrangements for improvements that will enhance the value of the paper, and we are justified in promising that subscribers will receive full value for the increase of price.

The Rogers Locomotive Company have taken 10 locomotives for the Grand Trunk.

Specifications are out for 20 passenger cars for the New York, Lake Erie & Western.

The Delaware & Hudson is said to be in the market for some new passenger equipment.

The New York, Ohio & Western are contemplating some additional first-class equipment.

The Boston, Concord & Montreal are said to be in the market for some additional passenger equipment.

The Eastman Car Heater Company have orders from the Lehigh Valley for 100 cars and the same number from other roads.

A statistician estimates that the number of passengers carried each day on all the railroads in the world average 6,500,000.

The 500 New York, Ohio & Western coal gondolas have been let to the Lafayette Car Company, and to be built at the Lima shops.

The Bluffton Car Wheel Company is the name of the stock company recently organized to build car wheel works at Bluffton, Ala.

The Ontario management in letting the 500 cars took an option for 500 more of the same class at the same price, option to extend to Jan. 1st.

The New York, Susquehanna & Western specifications for 50 to 100 cars have not yet been sent out, but will probably be distributed this week.

The Philadelphia & Reading has just closed a contract with Pullman for 5,000 freights of the various types. The Butler draw bar attachment is specified.

Mr. Marden, of the Fitchburg, is pushing along as rapidly as possible his 250 freight cars. The demand for these cars, in fact for 1,000 additional cars, is felt very much.

The Madison Car Company, Madison, Ill., with authorized capital of $500,000, has been incorporated by L. M. Ramsey, Charles F. Orthurin and William Bacon.

The Columbia Street Car Company, organized about three months ago with a capital of $1,000,000, it is reported has purchased grounds in the western portion of Chicago, Ill., and expects to begin building operations at an early day.

The rolling mill department of the United States Rolling Stock Company at Anniston, Ala., has completed a piece of shafting 25 feet long, 7½ inches in diameter, and weighing 3,640 pounds. It was to be used in the works at Anniston.

A meeting of the directors of the Basic City Car Shops Company was held at Basic City, Va., recently, and work on the car shops was ordered to be pushed forward as rapidly as possible. The directors expect to have the three main buildings completed early this winter.

The Buffalo Car Company takes the contract for the 150 Lackawanna live stock express cars. These cars will be equipped with Mr. J. W. Baker's new iron brake beam, which will no doubt be examined with great interest by brake beam men, as well as railroad men generally, as it is quite a radical departure in this field.

The largest locomotive in the world, according to London *Industries*, is approaching completion in the works of J. A. Maffei, at Munich, where it is being built for the Gothard Railway Company. It is a "double compound" tender engine on the Mallet system. Its effective weight is 85 tons. It has six axles coupled in two driving groups.

The Smiley vertical plane coupler is abont to be launched upon the troubled waters. It is being made by S. J. Meeker & Co., malleable iron men of Newark, N. J. Steel knuckles are furnished by the Atha Steel Co. This coupler is said to be received with considerable favor by the Delaware, Lackawanna & Western and New York, Susquehanna & Western people.

An air brake, evidently intended for the controlling of cars having no locomotive attached, has been invented by O. B. Martin, of Akron, O. An air pump is located under the car, and is operated by suitable mechanism connected with the axle. The compressed air is collected in a large cylindrical reservoir, and ingenious provision is made to cut off the supply when the working pressure is attained.

The patent office record informs us that there is at present a tendency among inventors to design air brakes or attachments to air brakes that are patentable. Many ingenious inventions have been patented in this line within the last year. There has also been money spent on covering with patents a great many devices that are entirely impracticable and which no sensible railroad man would hesitate to estimate at their true value.

The Pullman Palace Car Company has just made its annual report to the Illinois State board of equalization. The report shows that during the last year the company has furnished sleeping and parlor cars on 126,037 miles of railroad, 4,428 miles being in Illinois. It furnished 2,050 sleeping and drawing-room cars. The whole property of the company is represented by its capital stock, which is $24,963,100, paid up. The company this year has increased its capital stock from $19,000,000 to $25,000,000.

Dispatches from Porter, Ind., say: The Anglo-American Parlor Car Company, composed of English and American capitalists, have recently purchased 300 acres of land, and it is expected they will be ready to begin work soon. The company is incorporated for $15,000,000, and will be the largest concern of its kind in the country. M. C. Meagher, president of the Chicago Porter Home Investment Company, was commissioned to make the purchase, and has received a number of inquiries from manufacturers in regard to locating here.

Some weeks ago a representative of the Baldwin Locomotive works sailed for Europe on his way to the Holy Land, his special mission being to set up locomotives built in this city for use on a railroad from Jaffa to Jerusalem. The locomotives, it is now reported, arrived at Jaffa on September 22. In this materialistic age the New World sends the great mechanical agent of civilization and development to the ancient land that furnished spiritual light to all peoples, centuries before the existence of America was known to the wise men of the East.

The Indianapolis Car Manufacturing Company, of Indianapolis, Ind., has been placed in the hands of a receiver. The appointment was made upon the application of John Voorhees, purchasing agent of the company, and a creditor for $2,500. He alleged that the company was insolvent, and Matthew Henning was appointed receiver. The company employs 800 men and the works are valued at $600,000. Mismanagement is reported to be the cause of the failure. It proves that business cannot be successful in the best of times when carried on by antideluvian methods.

For some time past work has been overcrowded at the Reading Railroad Company's car shops at Reading, Pa., and the 900 employés were informed last month that they can work 15 hours a day on Mondays, Wednesdays and Thursdays, and 10 hours on other days as heretofore. The coal traffic of the company is exceedingly heavy, and every car fit for service is needed to carry the heavy shipments. The brisk coal business, it is anticipated, will last for some time, and it is the desire of the officials to meet all the demands of this rapidly increasing trade.

Our correspondent, Mr. Charles Riach, Barnesville, Minn., sent to the editor of this journal a most cordial invitation to be present at a social meeting of the Carmen's Mutual Aid Association, held at Barnesville, Oct. 31. The recipient of the invitation felt certain that he would have spent a pleasant and profitable evening in the company of the carmen, and he felt desirous to be there, but a journey of nearly two thousand miles proved too great an obstacle. We sincerely hope that the carmen had a good time and that their enjoyment was not marred by the absence of the editor.

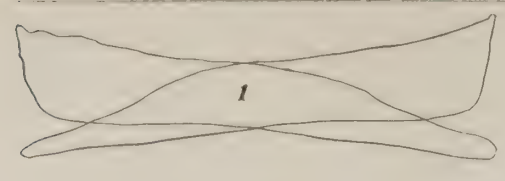
A mammoth bell recently cast at Milwaukee for the Wisconsin Central road has been placed in the tower of the new Grand Central passenger station of that road in Chicago. The bell, which cost $9,000, is 6 feet 9 inches in diameter, 6 feet high and 6 inches thick. It is made of copper and tin, and the hammer weighs 250 pounds. The tower of the building is 220 feet high and is to contain a clock, the dials of which will be 190 feet from the street. This clock is the second largest in the country, and besides the four dials in the tower it will run 26 dials throughout the building.

A commission has been appointed by the State of Pennsylvania to investigate the question of coal waste in the coal mines of the State. There is a good field for the labors of the commission. The waste connected with coal mining in Pennsylvania is simply enormous and, from an economic point of view, scandalous. Twenty years ago a committee was appointed by the American Institute of Mining Engineers to investigate this subject and the fact was made public that fully one-half of the coal in the veins was wasted. The utilization of anthracite slack coal of late years has greatly reduced this proportion of waste, but it is still very large.

The new shops at Sheffield, Ala., of the Memphis & Charleston Railroad, are nearing completion. With equipments they are to cost $120,000. The greater part of the railroad company's shops at Memphis is to be moved to the new site, as well as the shops now at Huntsville. The intention is to make the Sheffield establishment the principal shop of the road and one of the largest plants of the kind in the South. Two hundred and fifty to 300 skilled workmen will be employed at first. The Sheffield Improvement Company, of Philadelphia, will build thirty-eight residences near the shops, and these, added to those already in that vicinity, will make a village of some size. Steel rails will be laid at once on the switch track running from Sheffield by the shops to Tuscumbia, and the trains on the Florence, Sheffield & Tuscumbia road can thus run directly through.

Little progress has been made, says the Philadelphia *Ledger*, in the way of having cars heated by steam, instead of by dangerous stoves, save in the States that were bold enough to pass laws requiring the removal of stoves from passenger cars. In the face of declarations that the law was unwise, because it could not be carried out, New York has managed to have many of its roads equipped with steam-heated cars, and a decision rendered yesterday by the Court of Appeals will probably hasten the removal of stoves from cars belonging to companies that have defied the law. The court decides that the New York, New Haven & Hartford Company must pay a fine of $7,000 for failing to comply with the law, and, as penalties will be cumulative as long as the law is disregarded, this company and others will be compelled, in self-defence, to get rid of its stoves. That all companies can do so has been amply demonstrated by those that have adopted steam-heating systems.

The members of the Central Railroad Club are nearly all practical men with views on rolling stock matters that demand respect. But when anything can be done that will give scope to comprehensive practical humor, then the Central Railroad Club may be depended on to leave all rivals away in the rear. Not long ago some of the members found serious fault with the draft arrangement of certain cars belonging to the Delaware, Lackawanna & Western, of which Mr. Fred B. Griffith is master mechanic, at Buffalo. At succeeding meetings the faults of the draft rigging referred to were dilated upon and condemned in no mild terms. As mere talking failed to bring about a remedy, it was decided to be necessary that the club should take some combined action to intimate to the management of the company that an improved arrangement was desirable. As a mode of action it was decided that Mr. Griffiths be requested to introduce a resolution condemning the draft gear and intimating that it was dangerous. It is needless to say that Fred hired out the job, but the action of the club brought about the desired reform.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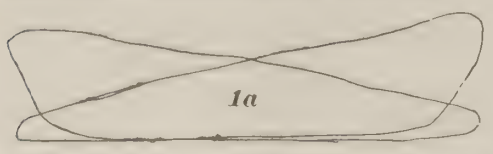
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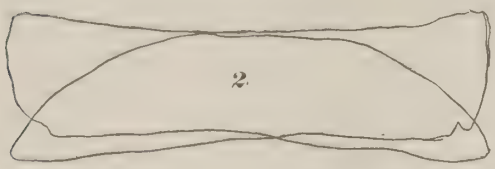
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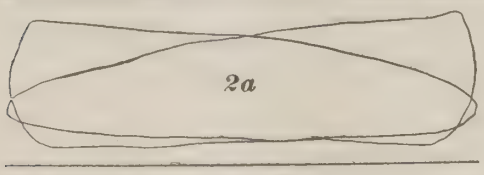
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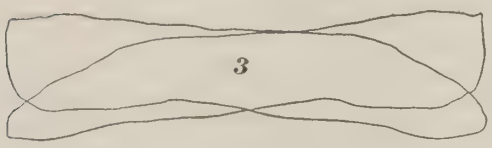
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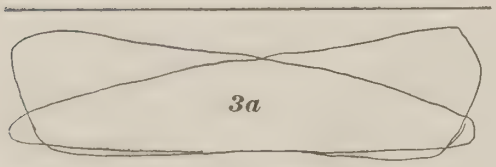
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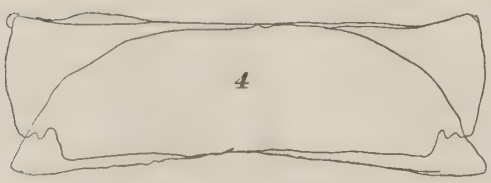
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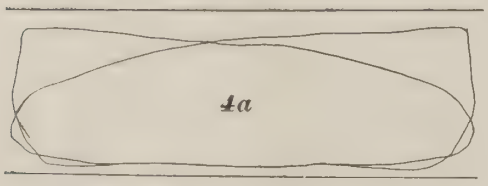
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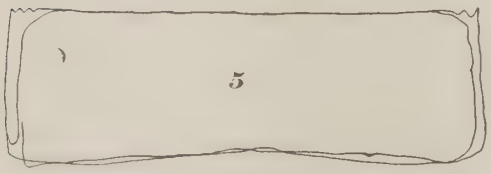
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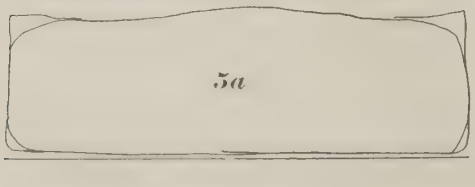
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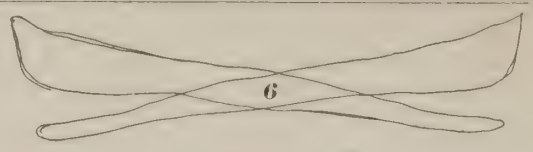
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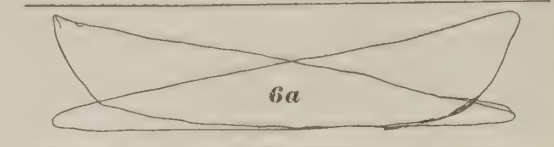
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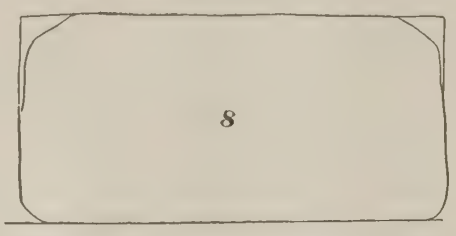
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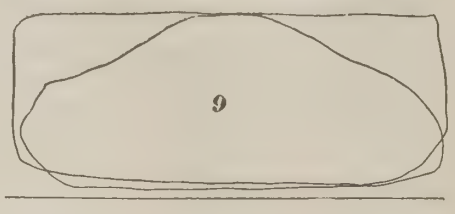
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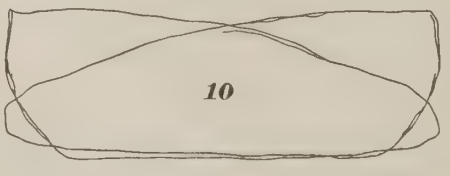
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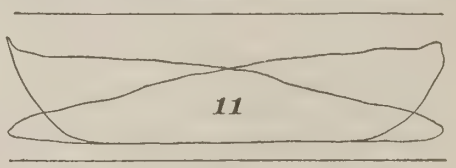
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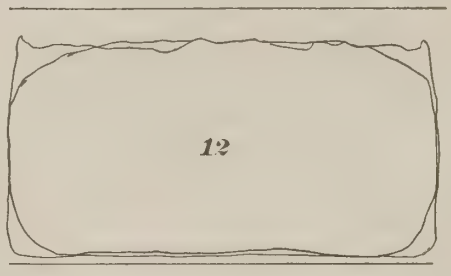
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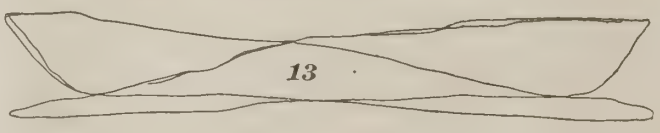
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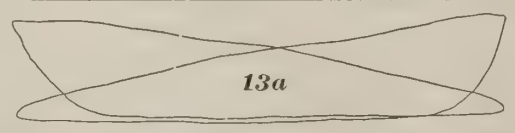
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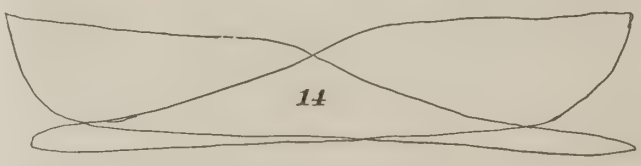
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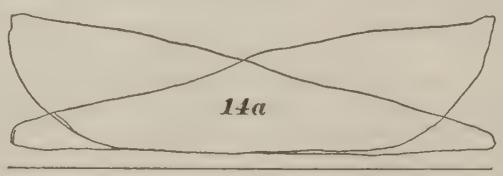
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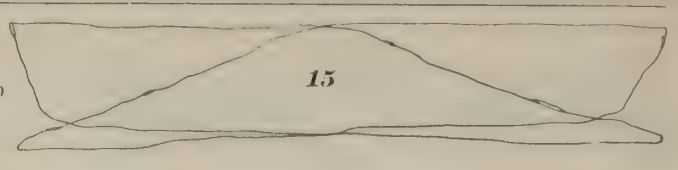
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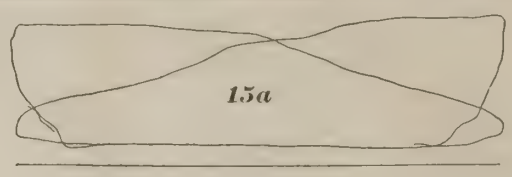
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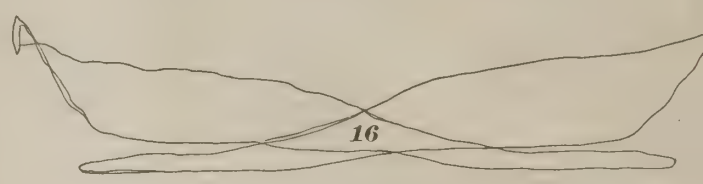
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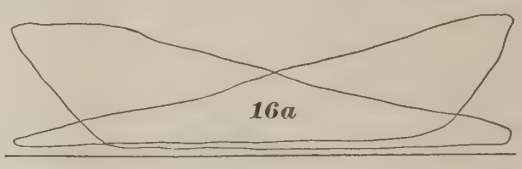
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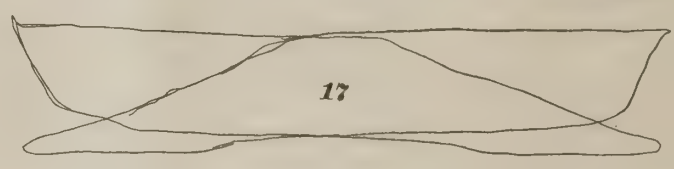
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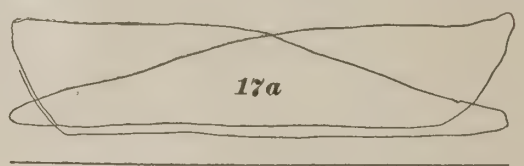
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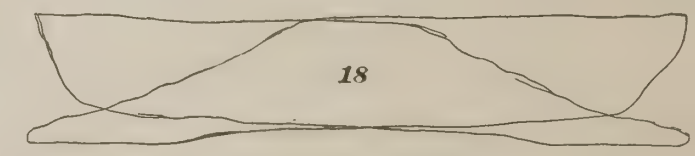
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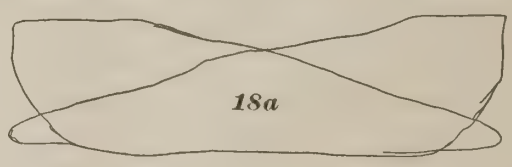
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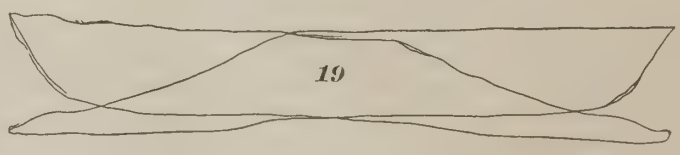
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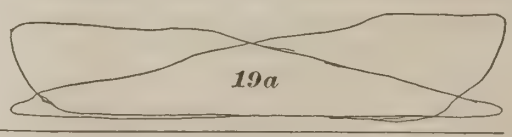
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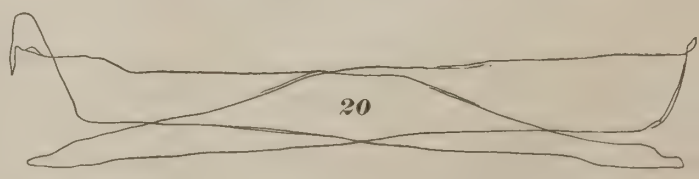
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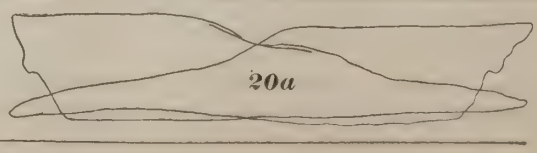
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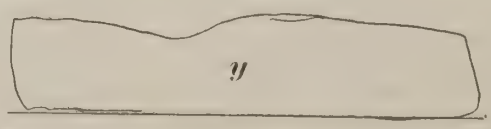
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DIAGRAMS FROM EAST TENNESSEE COMPOUND LOCOMOTIVES.

East Tennessee, Virginia & Georgia Compound Locomotives.

BY ANGUS SINCLAIR.

For three or four months the East Tennessee, Virginia & Georgia Railroad Company have had three compound locomotives, built by the Schenectady Locomotive Works, in use on their regular train service. There are two consolidation engines that are employed hauling freight trains on the hilly divisions terminating in Knoxville, Tenn., and a ten-wheel engine that has been working the heavy fast passenger trains that called for the use of ten-wheel locomotives. The latter engine does work in turn with simple ten-wheel locomotives that are noted for their efficiency and for their economy in the use of fuel. The consolidation compounds do the work in turn with simple consolidation engines with ample boilers and large fireboxes that produce highly economical results.

Since the compound locomotives went into service, the officers in charge have required an account of the fuel used to be kept as accurately as circumstances would permit, and the conclusion arrived at was that the compounds were doing the work with about 30 per cent. less fuel than that consumed by the simple engines doing similar service.

The intention of the officers in charge was to make accurate comparative tests after the engines had been at work for a few months, and Mr. W. H. Thomas, superintendent of motor power, invited the writer to be present and help in making the tests. Through a misunderstanding, I went to Knoxville early in October, before the mechanical department of the road was ready to carry out the work determined upon, but as I was there it was decided to make some trials which would show how the engines were working and be preparatory to others that will be made soon. In the course of a consultation with Mr. Thomas and Mr. Hudson, the very able general manager of the road, who is a civil engineer of mature experience, it was decided that the final comparative tests of the locomotives should be made with one train of known weight used on the same divisions by all the engines tried. These tests will be made when the condition of business will permit the arrangements to be carried out.

Single trips were made from Knoxville to Coal Creek, a distance of 31 miles and return, with one of the consolidation compounds, and with a simple consolidation locomotive, both of the engines hauling what was considered a full train. The division winds over spurs of the Cumberland Mountains, and is exceeding hilly and full of remarkably sharp curves. It is a very difficult piece of track to make comparative tests upon, for the work done in climbing up one grade is strongly influenced by the manner in which the previous hill was descended. I was not able to obtain a profile of the line, but railroad men may judge of the steepness of the grades and the sharpness of the curves, from the fact that 18 loaded cars is a full train for a 20 × 24-inch consolidation engine, and that on one of the grades about four miles long 11 loaded cars is all that the heaviest engine can pull. A pusher is used on this grade, and it assisted both of the trains on the return trip.

The consolidation compound locomotive No. 460 has a single high pressure cylinder 20 inches in diameter, from which the steam is exhausted through a receiver horseshoe pipe in the smoke box to the low pressure steam chest on the opposite side of the engine, and thence distributed into the low pressure cylinder 29 inches diameter. The admission of steam in starting is controlled by a Pitkin intercepting valve, but no reducing valve is used for regulating the admission of live steam to the low pressure cylinder at starting, the necessary reduction in pressure being secured by the small size of the pipe that conveys the steam. The stroke of both cylinders is 24 inches. This engine has a boiler built to carry 180 pounds steam pressure, which is the working pressure regularly employed. The driving wheels are 51 inches diameter. The high pressure valve has ¾ inch outside lap and ⅛ inch inside clearance; the low pressure valve has 3-4 inch outside lap and 3-16 inside clearance. Both valves have 5 3-8 inches travel, the throw of the eccentrics being 5 1-4 inches. A single exhaust nozzle 5 1-2 inches in diameter was used.

The simple consolidation engine tried has cylinders 20 × 24 inches, driving wheels 51 inches diameter, and the boiler carries a working pressure of 150 pounds to the square inch. The weight and general dimensions of this engine are the same as the compound. The exhaust nozzle of this engine is 6 inches diameter, the size used in all engines of this class.

The arrangements made for securing a record of the relative performance of the two engines were the providing of means for measuring the coal and water used, the taking of indicator diagrams and the gauging the rarefication of the smoke box pressure. Mr. Jacob Johann was kind enough to lend us a pyrometer for ascertaining the temperature of the smoke box, but it was decided not to use the instrument until more thorough tests were undertaken. Indicator diagrams were taken about every mile, Mr. J. B. Michael, master mechanic at Knoxville, taking the cards at one side, and the writer taking them at the other. The cards were always taken simultaneously. Tabor indicators were used with spring of 100 pounds scale for the high pressure cylinder and 80 pounds for the low pressure. The revolutions were ascertained by means of a Crosby revolution counter. One assistant in the cab recorded the revolutions, the steam pressure and the positions of the reverse and throttle levers. Another assistant looked after the quantity of coal and water consumed, and noted the waste occurring by the starting of the injector and by the safety valves blowing off.

On Oct. 7, engine 460 (compound) hauled a train of 32 empty cars from Knoxville to Coal Creek, the whole, exclusive of engine and tender, weighing 734,050 pounds On returning, the engine hauled 19 loaded cars weighing 1,290,450 pounds. During the round trip the engine used 5,073 pounds of coal and 41,058 pounds of water.

On Oct. 10, engine 473 (simple) hauled from Knoxville to Coal Creek a train of 29 empty cars weighing 689,100 pounds. In the return trip the engine had 18 loaded cars weighing altogether 1,313,050 pounds. The coal burned on the round trip was 7,040 pounds, and the water consumed was 49,788 pounds.

These figures show that the compound engine did the work with 72 per cent. of the coal and 82.4 of the water used by the simple engine. The methods of measuring the coal and water were not satisfactory, the latter being particularly open to error owing to the curves and grades at the points where the msasurements were necessarily made On the outward trip the compound had 22 tons more of a load than that pulled by the simple engine in the same direction, and on the return trip the simple engine had the heavier load by about 11 tons. The weather on both days of the tests was about the same in temperature and wind pressure, and there was no perceptible difference in the condition of the rails. The simple engine labored under two disadvantages during the return trip that were not experienced by the compound. A car on a preceding train had dropped grease upon the rail, which caused considerable slipping and sanding of the rail during the ascent of the four-mile grade, and the train was held twice for orders. On the other hand, the return train proved too heavy for the compound, and she had to double one hill. The compound engine developed less power than the simple engine when pulling hard on a grade, but the train hauled by the compound engine on the return journey seemed to pull harder than that handled by the simple engine, notwithstanding that it was 11 tons lighter.

PARTICULARS OF INDICATOR DIAGRAMS.

No. of engine.	No. of diagram.	Boiler pressure.	Revolutions per minute.	Throttle position.	Reverse lever notch.	Cut-off in inches	Mean effective pressure. F. stroke.	Mean effective pressure. B. stroke.	Scale of indicator spring.
460	1	170	196	½ open	4	16	33.3	33.3	100
460	1a	170	196	"	4	16	34 6	34.6	80
460	2	176	168	Full	3	18⅛	60.	63.3	100
460	2a	176	168	"	3	18⅛	48.	48.	80
430	3	178	174	"	3	18⅛	50.	43.3	100
460	3a	178	174	"	3	18⅛	42.6	42.6	80
460	4	172	68	"	3	18⅛	73.3	70.	100
460	4a	172	68	"	3	18⅛	57 6	57.6	80
460	5	171	18	"	1	21⅞	90.	90.	100
460	5a	171	18	"	1	21⅞	69.	69	80
460	6	165	242	⅛ open	4	16	23.3	20.8	100
460	6a	165	242	"	4	16	26.6	26.6	80
473	7	105	108	"	6	....	70.4	70.4	100
473	8	137	78	Full	1	....	122.	122.	100
473	9	142	108	"	8	....	92.2	92.2	100
473	10	133	198	"	8	....	70.3	70.3	100
473	11	137	270	Throttled	8	.	38.	38.	100
473	12	148	60	Full	1	....	126.	126.	100
254	13	162	223	"	5	14⅛	30.	32.5	100
254	13a	162	223	"	5	14⅛	29.3	30.	80
254	14	175	186	"	6	12⅛	40.	42.5	100
254	14a	175	186	"	6	12⅛	40.	40.	80
254	15	168	210	"	5	14⅛	47.5	50.	105
254	15a	168	210	"	5	14⅛	48.6	48.6	80
254	16	170	240	"	6	12⅛	25.	30.	100
254	16a	170	240	"	6	12⅛	34.6	29.3	80
254	17	173	210	"	5	14⅛	47 7	47.7	100
254	17a	173	210	"	5	14⅛	42.6	37.3	80
254	18	175	168	"	5	14⅛	50.	50.	100
254	18a	175	168	"	5	14⅛	45.3	45.3	80
254	19	162	186	.....	5	14⅛	40.	40.	100
254	19a	162	186	.....	5	14⅛	32.	32.	80
254	20	174	270	.....	5	14⅛	27.5	37.5	100
254	20a	174	270	.....	5	14⅛	33.5	33.5	80

Referring to the annexed indicator diagrams, Nos. 1 to 6 *a* inclusive are selected as a fair average of those taken from the compound freight engine while hauling a full train on the division run over. The amount of work done by the cylinders was constantly changing. On ordinary roads when locomotives pulling freight trains have the indicator applied at regular intervals, the greater part of the diagrams will be nearly of the same size and represent about the same amount of horse-power developed in doing the work. Here it was difficult finding two sets of diagrams that approximated the same measure of work, except it was those taken on hard steady pulls. Diagrams 4, 4 *a* for the compound and diagram 9 from the simple engine give a fair representation of the work done by both engines while pulling steadily, but not at the maximum effort.

Diagrams 7 to 12, inclusive, were taken from simple engine No, 473. They are remarkably good diagrams and display an excellent distribution of the steam.

Diagrams *X* and *Y* were taken from the low pressure cylinder of engine 460, when the engine was starting. Card *X* was taken on a steep grade when the whole power of the engine was exerted to put the train in motion. It will be noted that at the beginning of the stroke the direct steam put a pressure of 50 pounds into this cylinder, and that on the high pressure cylinder making its first exhaust the pressure in the low pressure cylinder went up to 67 pounds. In Card *Y* the engine starts easily and the supply of direct steam does not enter rapidly enough to maintain the initial pressure, and the steam line is falling when the exhaust steam from the low pressure side comes in and forces it upward.

Several of the high pressure cards of the compound engine are slightly distorted in the compression line, as may be noted particularly on Card No. 4. This is due to the inside clearance of the valve, and is caused by the steam from the exhaust of one end passing into the other end of the cylinder. The cutting out of the valve makes release on one end of the cylinder take place a little before the period of compression on the other end begins, and consequently the latter end of the cylinder is open to the exhaust when the exhaust port opens on the other end, so that there is nothing to prevent a portion of the steam from passing into the wrong end of the cylinder. It does very little harm, however.

On Oct. 11 the indicator diagrams from 13 to 20 *a* inclusive were taken from a 10-wheel compound engine while pulling a fast passenger train from Knoxville to Bristol. The object in taking these cards was merely to ascertain how the valves were set, and if the steam was properly distributed. The reducing motion used was different from that employed on the other engines, and was not a good arrangement. It made the card on the low pressure side longer than the other. These diagrams are worthy of attention, for they are the finest taken from a compound locomotive that we have ever examined.

The amount of draft in the smoke boxes of the three engines was gauged by a U glass tube charged with water. The draught on the tube was decidedly stronger with the simple engine than it was with the compounds, although the nozzles of the latter engines were smaller than those of the single engines. In working hard and fast, as in running for a hill, the simple engine would keep the water raised about 6 inches, but in the ordinary hard working the height of water kept about 4 inches. The compound engines raised the water about one inch less than the other. The difference in the temperature of the smoke box in the two forms of locomotives was very apparent to those sitting beside them. Although there was scarcely any difference in the weather, it was quite comfortable sitting alongside the smoke box of the compounds, while with the simple engine we were nearly parboiled when the engine was toiling slowly up grades.

The locomotives on the East Tennessee, Virginia & Georgia, demonstrate how successfully the single nozzle can be used in the hands of men who appreciate the advantage of using as large an opening as possible for the escape of the exhaust steam. The single nozzles on most of the engines look like nail kegs and the softness of the exhaust is apparent to every railroad man who listens to the engines, yet the smoke box vacuum appears to be as high as it usually is on other locomotives that have the nozzles choked to the smallest limit. The high vacuum is secured by making the nozzle and smoke stack harmonize. The smoke stacks used on most of the heavy engines are 16 inches diameter and made bell mouthed, the nozzle and stack forming an ejector that produces the maximum of draft with a minimum of steam velocity.

The compound locomotives in ordinary working handle the trains as easily as simple engines of the same size, and they are as easily operated as simple engines, but they are slightly deficient in tractive force on a long heavy pull or in starting a heavy train. The compound consolidation engine with cylinders 20 and 29 inches, and carrying steam of 180 pounds pressure was estimated to be of equal power to the simple consolidation engine with cylinders 20 inches in diameter and using steam of 150 pounds pressure. It was found, however, that the consolidation engine stalled on a hill with a lighter train than that taken up by the simple engine. A computation of the indicator diagrams will show the cause of this. The diagrams 5, 5 *a* were taken from the compound when she was exerting her full power and a minute or two before she stalled. Diagram 12 was taken from the simple engine at the same spot where the compound diagrams were taken and the engine was working as if she would take up another car. It will be found that the aggregate steam pressure on the two pistons of the compound was 73,844 pounds, while a force of 79,168 pounds was exerted upon the pistons of the simple engine. These figures show us that the compound engine is nearly 7 per cent. less powerful than the simple engine when both are exerting the maximum tractive force.

The Canadian minister of customs was waited upon lately by representatives of the National Despatch Company, of St. Albans, Vt., and the Canada Atlantic Railway, in reference to a matter of interest to railway companies. The representatives desire to obtain permission to bring carwheels into Canada free of duty to replace wheels which may be broken on cars in Canada. It appears, however, that this concession is not allowed to Canadian railways in the United States, nor to the manufacturers of carwheels in Canada, and under the circumstances consideration of the matter by the government will be necessary. The minister suggested that the application should be put in writing, and then, he said, he would submit it to his colleagues. He also said that if reciprocal arrangements could be made he thought the proposal would be of benefit to the railways of both countries.

Steel-Tired Wheels.

The following is an abridged report of an address made by Mr. J. N. Lauder, Old Colony Railroad, on steel-tired wheels at the October meeting of the New England Railroad Club:

As regards engine-truck wheels, tender and car wheels, the practice of using steel tires has not become universal, and probably never will in this country, on account of the additional cost of running steel-tired wheels over the cost of running chilled cast-iron wheels. I think there is no question that it costs more per mile to run the former in any kind of service than the latter, with the possible exception of some very long through runs, such as are made by the Pullman and Wagner cars. In that case the cost per mile would figure as low with steel-tired wheels as with chilled iron wheels, because the wheels are worn out so much more rapidly than those in use on local trains that the item of interest on the money invested does not count to that extent. But for all ordinary purposes the chilled wheel undoubtedly is very much cheaper to run than any steel-tired wheel that has yet been made.

The reason that steel-tired wheels are coming more largely into use, notwithstanding they cost so much to run and maintain, is because it is generally supposed there is more safety in their use. The question, however, of the comparative safety of the two wheels is still an open one to my mind. When we consider how many hundreds of thousands, perhaps millions, of chilled wheels are run at the present time all over the United States, we find that the percentage of breakages is so small as to be hardly worth considering; but once in a while a chilled wheel breaks. Now, if a train is ditched or derailed, especially a passenger train, on account of a chilled wheel breaking, the railroad is put in a very bad position before the public, before the railroad commissioners, if the State has them, and before the courts, while on the other hand, allowing that the steel-tired wheel is no safer than the chilled wheel, if the train is derailed by a broken steel-tired wheel, the road stands much better before the public, the commissioners and the courts, than if they had used the cheaper wheel, because it can truthfully say it has used the best known wheel without regard to price. That is the reason that most of our roads are equipping their passenger rolling stock with steel-tired wheels. There is this to be said in favor of that wheel, as regards safety, that in the manipulation of the tire in the process of manufacture any mechanical defects in it can very easily be detected, and the tire rejected, which is not the case in the making of cast wheels.

Solid steel wheels are being made in different parts of the country. My chief objection to that kind of wheel, allowing that we get the mileage out of it that we do out of other wheels, is that it is almost impossible to detect defects that may exist in the structure of the wheel during manufacture, much more difficult than in the making of cast-iron wheels, and until the makers can overcome this difficulty they will have up-hill work in introducing their wheels. We all know the importance of having every wheel absolutely sound.

KEEPING STEEL TIRES IN RUNNING ORDER.

In regard to the maintenance of the steel-tired wheel, I consider this branch of the subject as the most important, because when such wheels get sharp flanges, and have to be removed and turned, that is an expensive job. Any means that can be devised to prolong the time between turnings, and at the same time keep the tire in reasonably good condition for service, is a step in the right direction.

We have used the Ross shoe for several years on our road, and we have come to the point where I am quite enthusiastic over its performance. The shoes furnished by Mr. Snow some years ago had a very detrimental effect upon the face of the tire. I had some tires badly cut by the so-called Ross-Meehan shoe, which is a shoe with steel slugs in the face of it. The object was to keep the tire worn down on the outer part of the tread, and on the flange as fast as the rail wears the tread. But my observation is that the Ross-Meehan shoe, especially in suburban service, where there is much braking, wears the tread of the wheel faster than the rail wears it, making the tire imperfect in a short time, and to some degree dangerous. To obviate that difficulty we have used the shoe without the slugs, what is called the Ross shoe, made of a good quality of cast iron. That shoe, in all local service where the brakes are applied quite often, seems to just about keep the wear of the tire uniform over its whole face. I have recently removed the tires of 42-in. wheels that have made 144,000 miles between the first and second turning; up to the first turning they had made 44,000. The Ross shoe is the only device I know of that will prolong the life of the tire and give it qualities that will keep it in use much longer between turnings.

This form of shoe has another quality that I am at a loss to account for, and that is, it seems to keep the flanges from getting sharp. This may, perhaps, be explained in part by the fact that the ordinary plain shoe might be hung in such a way as to have a tendency to sharpen the flange, while the Ross shoe is held in position by locking over the flange, so it will not have that effect.

MACHINES FOR TRUEING WORN WHEELS.

Now, in relation to machines for turning off the wheels, trueing up the tires when they become worn out of shape we are familiar with the four or five different designs in use, of car-wheel turning lathes. They are all based, I think, practically on one principle; I think they are all patterned from the original lathe that Mr. Washburn designed at Holliston, and have the same underlying elements that that machine had. We have heard some pretty wild statements as to the capacity of different lathes. I have heard it insisted upon that in 10 hours' time six pairs of wheels could be turned; that the average was four pairs per day. I cannot get any such service out of my machines; I have three of different manufacture, and I think they do well if they turn two pairs of 42-in. wheels in a day. I know that under some circumstances more rapid work can be done; for instance, on tires not badly worn, that simply want trueing, or that may be of very soft iron; but taking the tires as they ordinarily are, worn badly, in all sorts of shapes, with hard spots in them, I don't think it possible to turn more than two pairs of 42-in. wheels per day and follow it.

Mr. Marden mentioned that the Fitchburg Railroad have been using steel-tired wheels since 1881, and that they are now putting them under all their passenger equipment. Have removed but one pair for being worn out, and it made 399,000 miles. Made careful comparisons and found cost of steel tires and chilled wheels about the same. Steel-tired wheels make greater mileage than chilled wheels without bringing the car into the shop. During the last two years slid wheels have run about 25 per cent. out. When wheels begin to sharp flange they are turned round. Great care is exercised in mating wheels. Believed that an increased mileage could be secured by turning off the wheels every 50,000 miles if they inclined to sharp flange. Have Miles lathe that is guaranteed to turn four pairs of wheels per day. Have turned six pairs on it.

Mr. Snow, of the Ramapo works, read a paper on the method of equalizing the wear on steel-tired wheels. He spoke of the importance of keeping tires in proper shape and said that nothing could do this better than a brake shoe so devised that the rubbing wears the portion of the tire not worn by the rail. The Ross-Meehan shoe fulfills these conditions.

Messrs. Adams, Lauder, Clark and Coughlan participated in a discussion that followed.

The Time Convention.

The fall meeting of the General Time Convention was held at the Hotel Brunswick, New York City, on Wednesday of this week, the president, Col. H. S. Haines, in the chair. About 90 representatives were present. The date fixed for the change of time is Nov. 16. The Executive Committee reported 169 companies as members of the convention, operating 121,442 miles of road. A revision of the rules of order will be presented for action at the next meeting.

The President, in opening the meeting, delivered an interesting address concerning the various departments of work now before the convention. Col. Haines thinks that the Train Rule Committee can yet do much good work and that some of the rules could with advantage be made more full and explicit than they now are. As the block system is expensive, measures must be taken to improve our present practice. The engineer of a train ought to take more active interest in protecting the rear of the train, and, indeed, he being generally the most intelligent man on the train, should have more specific authority over the rear brakeman, telling him, by signal, when to go back. Fusees should be more generally used, and by the engineer as well as by the rear brakeman. Engineers should be instructed to drop off a fusee one mile before reaching a point where he intends to stop or to slacken. Col. Haines and his subordinates have had highly satisfactory experience with fusees.

Col. Haines next took up car service, strongly urging the importance of the per diem system of settling for interchange. He then took up the subject of safety appliances and expressed the belief that the technical associations would meet the requirements. He said:

The principal aid which the General Time Convention can give to the introduction of meritorious safety appliances is to provide for their simultaneous adoption. This will hasten the general use of automatic couplers and continuous brakes on freight trains, of improved methods of lighting and heating passenger trains, and all devices that must be made interchangeable in order to be applied in through train service over connecting roads; and here is the field for the Committee on Safety Appliances. In this field it will collect and publish statistical information that will be of value because obtained at first hand and from authoritative sources. In obtaining this information the committee should have the prompt and cordial support of our members, and their circulars should have immediate and careful attention in order that its reports may neither be unnecessarily delayed nor based upon scanty or erroneous data. As I stated in my opening remarks, the matter which serves for our semi-annual meetings is the result of the assiduous and unselfish labors of these committees, and to them is due the gradual transformation of the General Time Convention from a schedule-making body to an association of the railroad companies organized for mutual benefit in the development and solution of problems connected with railroad management.

The Car Service Committee made a report which went into particulars of the daily mileage made by freight cars on different railroads:

The Committee on Safety Appliances submitted a report in which they endorsed the Master Car Builders' standard coupler, and recommended the use of improved methods of car heating. The report concludes:

The committee submits a synopsis of the legislation adopted in the United States bearing upon the subject of safety appliances. The indications are that unless the railroad companies themselves provide efficient appliances they will be constrained to follow systems which they esteem ill adapted to the end in view.

Improvements in Iron Molding.

While visiting the shops of the East Tennessee, Virginia & Georgia, at Knoxville, Tenn., we were struck with the high quality of some castings that were in the machine shop, made by the Knoxville Car Wheel Company. The castings were 21 inches in diameter and were cylindrical shells intended for brushing locomotive cylinders. The thickness of the shell was slightly over one inch and it did not appear to vary $\frac{1}{16}$ inch in any part. The castings were perfect cylinders and were as clean and free from flaw as castings of ordinary form to be seen turned out from foundries that make a specialty of machine castings. While examining these castings we reflected on the remarkable improvement that has been made in the molders' art within the last quarter of a century. We are accustomed to hear glowing accounts of the advances made in the machine trade, or in all lines where cutting tools are employed, but comparatively little is said about the progress made in casting iron and steel to exact forms. Every reader of mechanical literature is familiar with the satisfaction expressed by James Watt at finding that a cylinder 18 inches in diameter, was so well made that a half crown could not be pushed between the piston and cylinder at any point. But few people know about a case that happened in this country about 25 years ago, and which illustrates the rapid strides our iron molders have made since that time. Mr. Milholland, the famous master mechanic of the Philadelphia & Reading Railroad had received some camel locomotives, which were decidedly over-cylindered, even for a period that found large cylinders and small boilers toiling together in ill-assorted union. Mr. Milholland determined to bush the cylinders of his engines, and he put in brass linings with the very worst results. The material cut out so badly and so rapidly that a few trips cleaned out a set of bushings. Mr. Milholland was a very bright man, and understood that cast iron was the material needed, and he tried some of the best foundrymen in Pennsylvania to cast thin linings for the cylinders, but they could not do the work satisfactorily, and he was compelled to use gun metal.

Luxurious Private Cars.

The St. Charles Car Works recently built for the Monterey & Mexican Gulf Railway a fine private car called the "Sierra Mojada." The car is 66 feet long and the interior has been arranged with an observation room at each end of the car, furnished with beautifully upholstered easy chairs, pier mirrors and velour drapery. Adjoining one of the observation rooms are two private rooms finished in prima vera and luxuriously upholstered and draped in old-red plush and velour. Four sections are placed in the centre of the car which are upholstered in blue plush; adjoining are the lavatory, heater room, pantry, kitchen and lockers for crockery, glass and silverware, and hot and cold water is furnished in abundance. The illumination is effected by the Frost Carburetor System of lighting cars. An extra amount of storage room was provided for the purpose of making long journeys into the interior of Mexico where northern delicacies and conveniences are not obtainable.

The same builders have turned out for the Rio Grande Western a fine officers' car called the "Nomad" which is 65 ft. long over body. This car is arranged with a large observation room, fitted with one large extension table, a sofa which can be made up into a bed, pier mirrors, and handsome, rich silk drapery, which harmonizes excellently with the French oak finish which is used throughout the car. The sections, which are furnished with upper berth of the latest standard pattern, are finely fitted out with drapery and hangings to conform to the observation room. Stepping through the opening of the section bulkhead, which is neatly draped with a portierre, one enters into a corridor along the side of the car. From this corridor leads the entrance into the large private room, the interior of which is furnished with a large sofa which can be made up into a commodious and comfortable bed and an upper birth above it. In one corner of this, near the side of the car, is a lavatory and wardrobe with pier mirrors from top to bottom in the door. The upholstery entirely conforms to the French oak finish. Adjoining this is a large bath-room with closet, finely furnished with every convenience for its purpose. Stepping out of this bath-room into the corridor the next door opens into a smaller private room, adjoining which is another private room of the same size. The partition between these two rooms is made to slide up or down, enabling the occupants to turn the two rooms into one, as may be desired. These rooms are furnished in upholstery and drapery like the others, but are each especially provided with hot and cold water lavatories. Immediately adjoining these rooms is a second bath-room, furnished with bath arrangements, hot and cold water douche, house-closet and lavatory in the most complete manner. Coming from this bath-room, and walking along the diagonal passageway until you come to the side of the car, are found the heater room, linen and other lockers placed on the left side, while on the right are the pantry and kitchen, furnished with all modern improvements, such as hot and cold water tanks, refrigerators, lockers and cupboards. A commodious servants' room between the kitchen and the end of the car, with sofa and upper berth, lavatory and water-cooler, completes the interior. The platforms are very spacious, and that at the servants' room end of the car holds a vegetable refrigerator, while the one at the observation room end of the car is provided with an awning, supported by four adjustable posts. The latter can easily be taken down and carried in a locker near the heater room. Both platforms are enclosed by railings and gates covered by a mahogany handrail to avoid touching the cold iron. This car is equipped throughout with the water-pressure arrangement for both hot and cold water, illuminated by the Pintsch system of gas, and ventilated by the No. 1 Creamer and automatic reversing ventilator system.

Railway Car Construction.

BY WILLIAM VOSS.

Nineteenth Paper.

PASSENGER CAR SUPERSTRUCTURE (*Continued*)—EXTERIOR.

The lumber used for the covering of passenger cars is almost invariably yellow poplar, this being particularly adapted for the purpose, because it is not resinous and has a close grain, therefore making the best possible foundation on which to paint. It should be thoroughly seasoned before it is applied and also carefully selected; the soft variety is to be preferred, as it is less liable to check and split; sappy pieces are of course not permissible in any parts of the exterior, as they decay very rapidly.

Passenger cars have in some few instances been covered with the different varieties of cabinet wood, notably mahogany, in which case no paint is used, except what is necessary for striping or other ornamentation. The surface is prepared with fillers and then varnished like the interior wood work. This style was not more generally adopted, not so much for consideration of expense, although this is greatly increased by using a more costly wood, but because a car so finished becomes weather stained in a very short time, even with the best of care and frequent coats of varnish, and must eventually be painted; and also because when new it does not present a better appearance than a car that is well painted and judiciously ornamented.

Fig. 138 is a modern example of paneling which was until recently the standard for passenger cars, and is so yet on a large number of roads. It differs from the old style principally in that the curved tops of panels and windows have been abolished. The panels are about $\frac{3}{4}$ of an inch thick, although $\frac{1}{2}$ inch is in some instances being used, in which case it is, however, usual to face the reverse side with canvas to prevent splitting; the width of the panels seldom exceeds 14 inches, as beyond that they become troublesome. The panels must be attached with the greatest care or they will warp and split; the edges being covered with battens may be secured with nails, but screws must be used for the remainder; the heads of these are sunk $\frac{3}{8}$ of an inch below the surface, and the counter-bores containing them are stopped with plugs of wood which are applied with glue and with the grain running in the direction of the diameter. In addition to the above fastening, it is customary to use glue for the surfaces in contact with the frame, and also to apply what is termed blocking wherever this can be done.

Before the window panels can be applied the window sill must be in place. This like the corner and door posts is usually of ash, because this wood is considered more serviceable; the best lumber for this purpose, however, is black walnut, but as that is rather expensive, of late years it is but seldom used. A considerably inclined sill is to be preferred, because it drains off the water much quicker, and therefore allows less of this to penetrate the joints at the base of the windows.

The space above the windows is closed with a letter board, so termed because it is used for applying the name or the initials of the company owning the car; it is usually $1\frac{1}{2}$ inches thick and 15 inches wide measuring from the top of the side plate, but 10 or 11 inches only are in sight. In some cases, especially when the windows have only one sash and therefore are comparatively low, a panel showing about three inches is placed between the top of the window and the letter board; it is of the same thickness as the other paneling, and its lower edge is cut out to correspond with the ususally rounded corners of the sash. Extending from this panel downward until they meet the window sill are L-shaped strips, usually of ash, which cover the corner of the window posts and do duty as outside sash stops.

All the joints are covered with battens which are of various forms and dimensions; those at the corner and door posts and at the windows being ordinarily $\frac{1}{2} \times 1\frac{1}{2}$-inch poplar strips with beveled edges. Those covering joints of the panels below the belt are usually much smaller, and because of this of hard wood; their size is about $\frac{5}{16} \times 1\frac{1}{4}$ inches, and the form either oval or flat with rounded corners. Metallic battens of a still smaller size are also much used for covering a portion or all of these joints when it is desired to make them less prominent, but not as much as formerly.

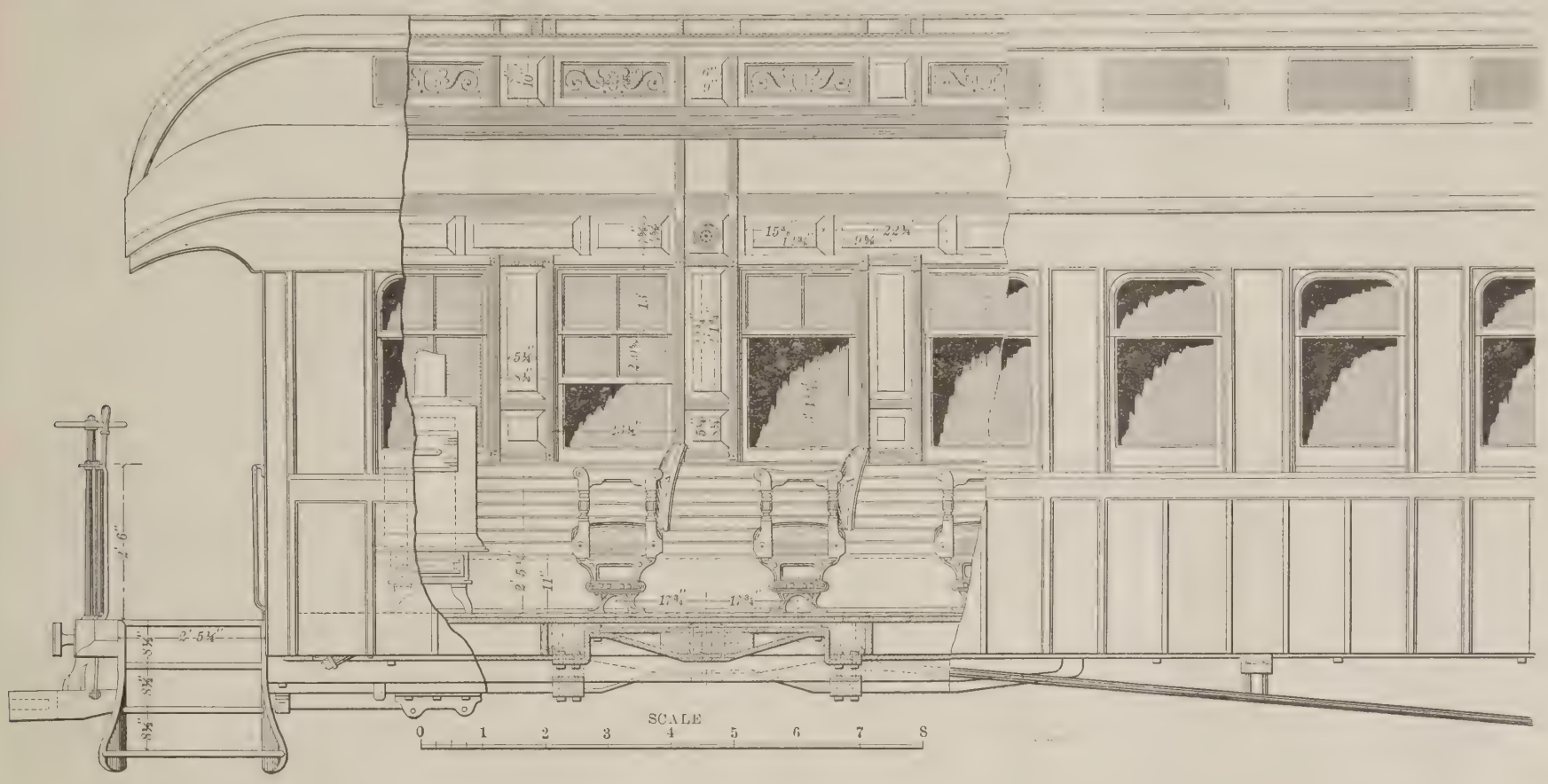


Fig. 138

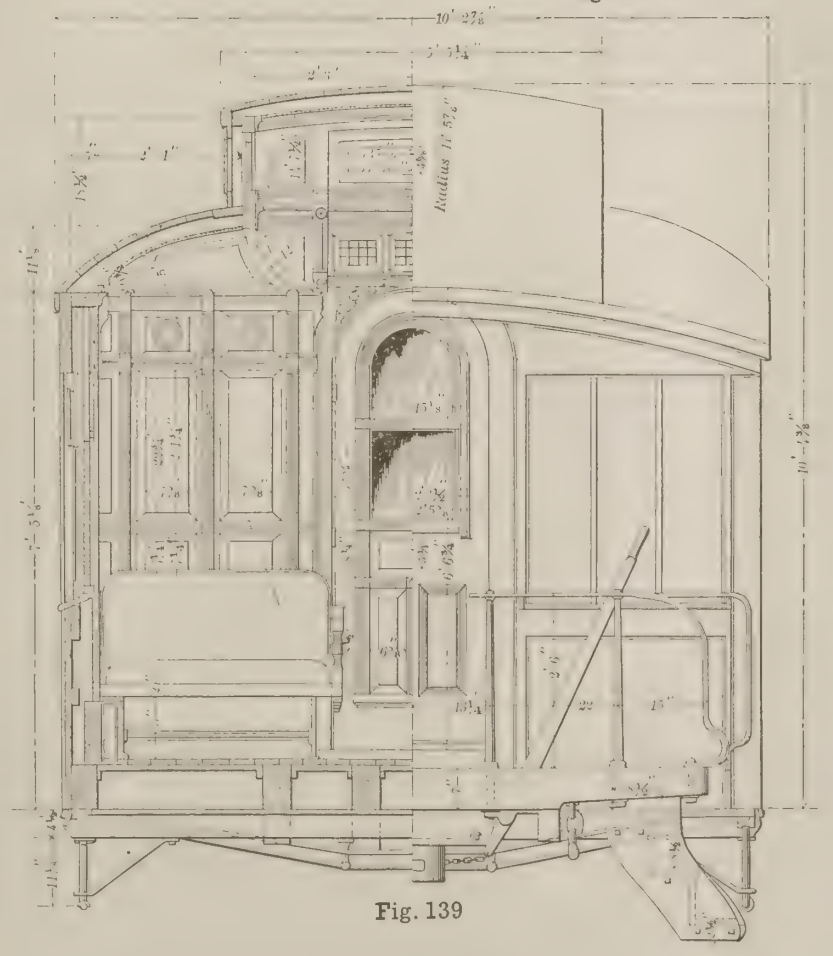


Fig. 139

At the eaves is placed a molding which is continued around the car, as shown; it is about $1\frac{1}{4}$ inches thick and $2\frac{1}{2}$ inches wide on the face, and of such a form that the water, shed from the roof, can drip from it without coming in contact with the side of the car. Frequently an eaves fascia, a $\frac{3}{8}$ or $\frac{1}{2}$-inch board with a beveled or molded edge, is used in addition to the molding, but usually only where the edge of the side plate is placed flush with the face of the letter board and something to cover the joint is needed. The fascia should be omitted in all cases where the construction does not require it, as it is not much of an ornament, and everything tending to unnecessarily cumber the structure is best avoided.

The exterior is now more generally applied with narrow-tongued and grooved boards in place of the panels. The change was made because the wide panel boards are expensive to maintain; they are liable to check and split even when the best of care is taken in selecting the lumber. This form of sheathing was at first objected to because it was supposed to detract from the appearance of a car, but this is rather added to if the work is neatly done; the most expensive sleeping and special cars are now covered with it. To obtain the best effect the strips should be very narrow, from $1\frac{1}{2}$ to 2 inches, exclusive of the tongues, or be center-beaded if they are double this width. The form of these so-called beads, but which are in reality grooves, is semi-circular or V-shaped with either sharp or rounded corners, the latter being the most popular; the grooves are very minute, and do not exceed $\frac{3}{16}$ of an inch. The boards are secured in place in all properly-constructed cars by blind nailing through the tongues, with glue applied at the back and joints and the above-described glue blocks at the posts and panel rails; if more than 2 inches wide some additional nails are driven through the face of the boards also.

As the window panels of ordinary day cars are comparatively narrow, and therefore less troublesome, they are usually in one piece as before, but are frequently worked on the face to resemble ceiling boards for the sake of a uniform appearance. This is notably the case on sleeping and other cars where every alternate panel is frequently 12 inches or more and a few very wide ones occur, as these and the panels at the ends, in which there are usually no windows at all, are composed of matched and beaded strips like those used below the belt rail.

In some instances the belt of the car is not continuous, a separate sill being provided for each window; in that case the exterior resembles that of baggage, express and mail cars, the only difference being that these have a smaller number of windows, if any. This class of cars is represented by Fig. 140, in which a window and a portion of a side door have been introduced to show the manner in which the openings are treated. On these cars the letter board is not infrequently omitted, and a narrow fascia board under the eaves molding substituted, especially when there are no windows and no arch over the door is used; the sheathing usually extends through to the plate whether a letter board is used or not.

The construction of the deck side exterior varies with the arrangements made for windows and ventilation. In the case of stationary windows, a light covering surrounds the openings and covers the face of the frame and a soffit board and eaves molding complete the finish. When the deck sash is on hinges for purposes of ventilation, as is now more generally the case, a screen is placed several inches distant from the windows, and this with the addition of a narrow fascia board and molding forms the exterior.

ROOFS.

The standard roofing material for passenger cars is tin plate applied in the usual manner. The fact that a tin roof requires constant attention and has a comparatively short life has led to attempts of substituting a heavier material, such

as galvanized iron, but the benefits derived thereby do not seem to warrant the increase in weight and cost. The weak points of any metal roof when used for rolling-stock, are the seams on which the cinders ejected from the locomotive stack act with an effect similar to that produced by a sand blast; a thin plate is therefore to be preferred, because it makes a less prominent seam. The platform roofs, especially when they are of the round variety so much used now, should, however, be covered with a heavy plate, as the cinders act in this case more on the body of the sheets than on the seams, these being turned in an opposite direction.

The tin, or whatever other material the roof proper may be composed of, is supported by the roof boards. These are tongued and grooved strips of from $\frac{5}{8}$ to $\frac{3}{4}$ of an inch thick, which are applied longitudinally and with screws instead of nails to obtain the greatest possible amount of lateral stiffness in the roof. For the same reason it is advisable to use wide boards; these are made sufficiently pliable to form the required convex surface by partially cutting through them longitudinally at intervals of from 2 to 3 inches; ordinarily, however, boards of from 5 to 6 inches wide only are used. For the roof ends it is necessary to use very narrow, thin and pliable strips and apply them in two layers to obtain the required thickness; in most cases straight grained pine or poplar will answer this purpose, but when the curves are very severe bass wood has to be resorted to.

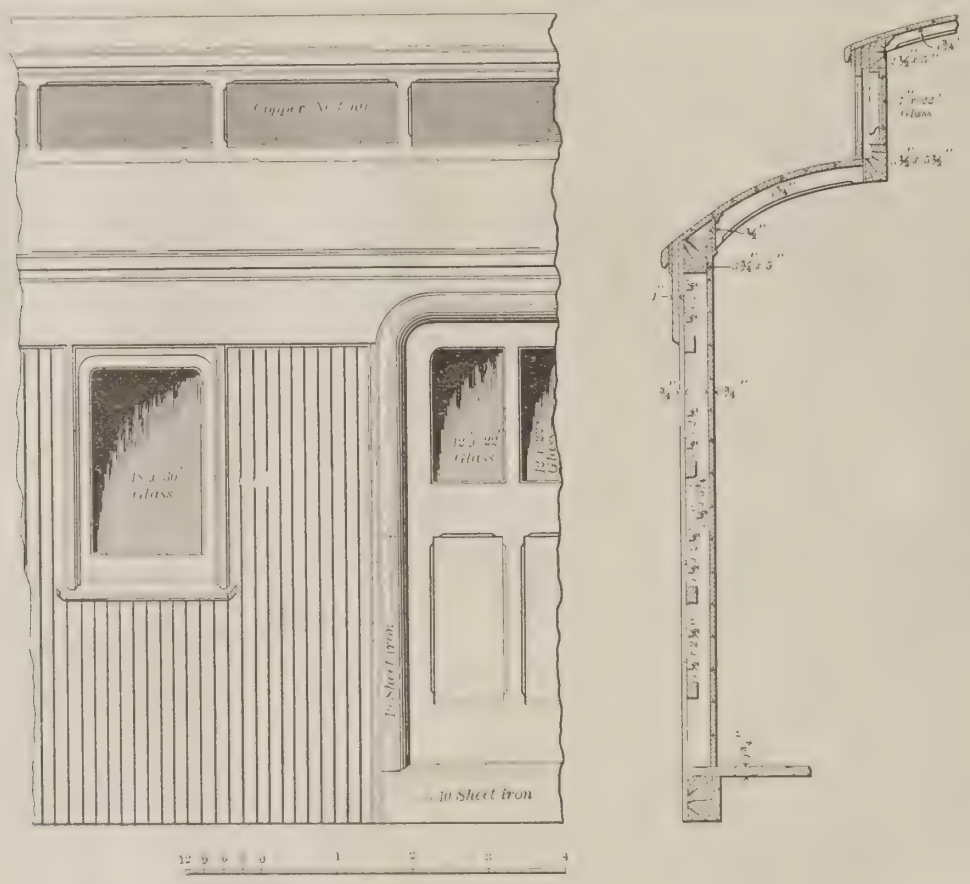


Fig. 140

Interior.

The inside lining of passenger cars, although to some extent structural, is principally arranged for decorative or ornamental effect. Nearly all the known cabinet woods are used for the purpose, sometimes in combination of two or more, but as this is now considered to be bad taste, especially when the contrast is very marked, only one variety is used for the modern car; this includes the doors, window sashes and blinds, and frequently the head lining when this is of wood, although a better effect is produced by a ceiling of a different but harmonizing color.

The leading woods for interior finish are quarter sawed oak, mahogany, cherry, ash and black walnut. Oak is at present the favorite; its strongly marked grain gives it a beauty possessed by no other wood; its color is sufficiently light, and it is comparatively inexpensive. Mahogany, which is unquestionably a more handsome wood, has the fault of darkening too much with age, and is rather too costly for ordinary day cars; it is, however, still in great demand for the best classes of cars. Cherry is used to some extent, but usually in combination with some other wood, as its grain is not pronounced enough to recommend it to be used alone; it is one of the best woods of which to make doors, sashes, blind frames and moldings. Ash has been largely used either alone or with mahogany or cherry trimmings; it is, however, difficult to obtain it of a uniform color, and was probably abandoned for that reason. Black walnut, was not many years ago, the only wood used for the finish of drawing room and sleeping cars and to a great extent for that of all classes of cars; its use was discontinued because it is too dark and became so scarce that it is now difficult to obtain; at the present time a car finished in walnut, either in whole or in part, is an exception.

The inside lining or finish is constructed and applied as follows: The wainscoting, as that portion below the windows and above the truss plank is termed, is either composed of narrow matched and beaded strips applied longitudinally, or of three members—two rails and a panel. Both the upper and lower rails in that case are $\frac{3}{4}$ of an inch thick and about 6 inches wide, the former requiring to be substantial, as the seat, back, arms and stops are attached to it. The rails are rabbeted to receive the panel which is $\frac{1}{2}$ inch thick. There is usually no great attempt made to ornament this part of the finish; the edges of the rails are, however, chamfered or molded, and sometimes a series of grooves or beads are cut in the panel.

On the upper wainscot rail rests the inside window sill; this is about $\frac{1}{2} \times 4$ inches, and is nailed to the above rail and to the window sill furring. In some cases a window sill cap and a belt molding under the sill proper are added, but ordinarily nothing more than the single member shown in the example is used.

The wood work above the windows is usually arranged in much the same fashion as that below these and with rails and panels of about the same thickness. Sometimes nothing more than these three members are used, in which case the panel becomes a belt molding, its surface being variously shaped, beaded and carved. In other cases the rails are continuous, but the panels are in short sections, usually corresponding in length to the width of one or more windows. They are separated by stiles framed in between the rails with a mortise and tenon. The edges of both the stiles and rails are chamfered, or molded, and grooved to receive the panels. The panels may be flat and surface carved, be beaded or have raised centers, which may be left plain or also be ornamented with carved rosettes, beads, etc.

The space between the windows is lined with panels which are applied vertically. These are about $\frac{3}{4}$ of an inch thick, and usually very elaborately ornamented with grooves and carving. In the older cars they are let in flush with the posts, the window stops in that case being band moldings which are often fitted with a small capital and plinth; a bed molding is placed in the offset at the top of the panel and is continued across the top of the window opening. The window panels of modern cars are usually placed flush with the lining above the windows and are so ornamented as to resemble pilasters.

At the junction of the side and head lining is a large molding to properly terminate the wall finish; and supplementing this, very often a narrow fascia board, the lower edge of which is notched or in some other way ornamented.

Some additional work is required at the ends unless the ceiling is hipped, in which case the side finish is simply continued until it meets the door opening. In other cases the additional space is paneled as shown in the different sketches.

The deck finish consists of a $\frac{1}{2}$ inch facing around the window openings, a cornice at the deck ceiling and a more or less ornamental deck sill facing with one or more moldings.

The head lining is either a painted canvas or of three-ply veneer, the center of which is of $\frac{1}{8}$-inch poplar. It is manufactured in molds of the exact curve required and in sections corresponding in length to the spacing of the side windows. These sections are secured in place with nails and the whole surface is divided off into panels by narrow moldings, some of which are necessary to cover the joints. The veneer head lining is always more or less decorated, but is usually not painted, although this is done in some instances, especially when the design is partially in relief.

The saloon and other partitions are built up of stiles, rails and panels much in the same manner as a door is constructed and are of a design in keeping with the finish at the sides; the stiles and rails are about $1\frac{1}{4}$ inches thick.

The interior of baggage and similar cars is not so elaborate. The sides and ends are lined with matched and beaded boards of the usual dimensions and which are applied horizontally. Ordinarily there is no head lining in these cars; the roof boards are beaded on the under side and the rafters, deck sills and plates, etc., are dressed and chamfered; a molding and fascia board at the junction of the roof and lining completes the finish.

Rhode Island Compound Locomotives.

We have mentioned several times in these pages that the Rhode Island Locomotive Works were changing three locomotives belonging to the Brooklyn Union Elevated Railroad Company from simple into compounds. One of the engines was delivered about the middle of October and has been at work on the principal line of the road ever since. We have been watching the operation of the engine closely, and have collected all the information about her performance that could be obtained.

The locomotives employed on the Brooklyn elevated system are all of the Forney type, with cylinders 11×16 inches, driving wheels 42 inches diameter, and weighing in working order about 24 tons. The engine altered into a compound, and now at work, is No. 58, the general dimensions being the same as the other engines. An ordinary observer would not notice that the engine was different in any way from the other locomotives running on the road, except that the exhausts of steam are fewer and softer. A close examination, however, shows us that one of the cylinders is larger than the other, and an engineer will notice that a circular appliance is let into the right hand side of the cylinder saddle, and that a movable stem connected with levers passing to the cab operates something inside. This is the intercepting or starting valve, and is the invention of Mr. Joseph Lythgoe, superintendent of the Rhode Island Locomotive Works. As far as we could learn, this valve is a movable ported cylinder, which provides the means of working the steam direct from the boiler in both cylinders when the full power of the engine is desired. This valve is not automatic, but has to be opened and closed by the engineer. In ordinary starts it is not employed, but when the engine is starting a heavy train on any of the steep grades, which are rather numerous on these roads, the valve is opened for a few turns of the drivers. The engine handles the trains as easily as any of the simple locomotives, and the only difference we could perceive in the working of this machine was that the engineer kept the throttle wide open and regulated the speed entirely with the reverse lever.

Before delivering this engine the Rhode Island Locomotive Works officials made several trying tests of her on a surface road with a heavy freight train, and they were highly satisfied with her performance. After the engine was put to work in Brooklyn, the builders made tests of her against the simple engine that had the best record for economy of fuel. The result of trials in two days' constant working was that the compound effected a saving of 19 per cent. in fuel, and a little more in the consumption of water. There is a particularly good opportunity of judging of the economical performance of different locomotives on elevated railroads, because the work done is fairly uniform, and the quantity of fuel supplied is measured with some degree of accuracy. These facts make the ordinary mileage sheet records of such lines accurate enough to stand by. According to the mileage sheets of the Brooklyn elevated, engine No. 58 is doing the work with a fuel saving of 21 per cent.

We believe that this is the fairest test of the relative economy of simple and compound locomotives that has ever been made, for both classes of engines use the same pressure of steam and both are worked under uniformity of conditions that can not be attained on surface railroads.

An incidental advantage of this improved form of locomotive for operating elevated railroad trains is that the softened exhaust throws out no sparks and the noise of working is reduced. The draft is so light that the usual spark catching netting in the smoke box can be dispensed with.

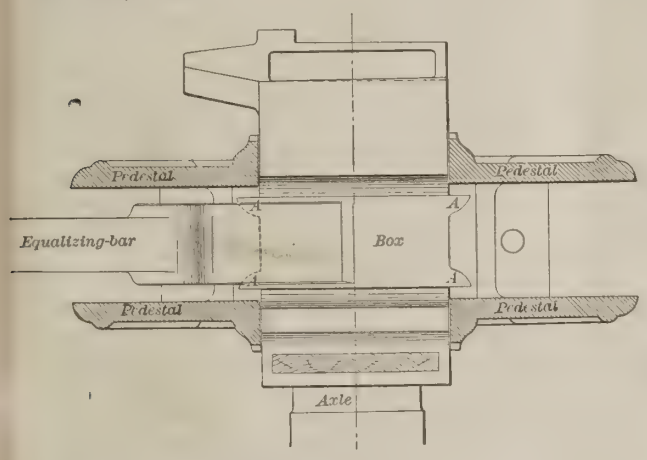
Great credit is due to Col. Martin, General Manager of the Brooklyn Union Elevated Railroad, for his business discernment and enterprise in providing for a fair trial of compound locomotives. An improvement that saves 20 per cent. of fuel is going to make a very material reduction in the operating expenses of an elevated railroad. That amount of saving appears to be assured, and it is enough to make a fair dividend to some companies that are now paying nothing to the shareholders.

A Heroic Engineer.

The newspapers have been gushing lately over the act of an engineer who performed an act of questionable bravery; and almost nothing has been said about an act which we consider one of the most heroic of the many noble deeds performed by locomotive engineers. The boiler of an engine which was running wild at night on the Chicago & Erie exploded, and Edward Murphy, the engineer, escaped with severe scalding and a broken leg. An express passenger train was following the engine. Although he was suffering excruciating pains from the scalding he had received, and the pain of his broken leg was almost beyond endurance, Murphy found a lamp and crawled back with it to flag the expected train. The act was a sublime instance of devotion to duty.

Six-Wheeled Truck.

One of the difficulties in the use of six-wheeled trucks is the want of flexibility in curving. The friction and wear on wheel flanges and brasses in the commonly-constructed truck is very considerable, to say nothing of the increase in power incurred. Several means have been employed to endeavor to prevent this trouble, with more or less success: a few of these might be mentioned: First, friction rollers placed between the top of oil-box and journal-bearing key, allowing the box to have a lateral motion on journal; this plan was not a brilliant success. Second, a more common plan is to use a short brass on the center pair of journals; although the flange wear may be decreased somewhat, the wear of brasses is very considerably increased, to say nothing of the greater liability of hot boxes. Third, the collarless journal is advocated by many eminent mechanics to overcome the rigidity of the six-wheeled truck; let us analyze this a little: the collarless journal advocates claim that there can be no end wear of the brass; that it will fit close, wearing as much at inner end as at outer end of journal. Now, if this were strictly true, how is it possible that the "collarless journal" can influence the rigidity of a six-wheeled truck? The ease of motion in this kind of truck is only gained at the expense of the pedestals being kept square with the frame. In fact, it is next to impossible to keep the pedestals square on any truck with collarless journals, as the thrust is entirely outward. Fourth is the flangeless tire on center pair of wheels; no doubt but that will produce the desired result, but at what a sacrifice; it involves a a special pattern of wheel, which is not at all times convenient, especially if



the car is in foreign territory. To make the flangeless wheel a success under any circumstances, it is absolutely necessary that the diameter and temper of both wheels on same axle are exactly alike, otherwise that pair of wheels will crowd one way and cause excessive end wear of brasses and boxes, as there is no flange to prevent it in part. In olden times when iron rails were used and a broken rail was no uncommon thing, the six-wheeled truck was quite often the agent that prevented the ditching of the car, and we are not entirely free from broken steel rails nowadays! What part would the flangeless tire take in the case of a broken rail? Not much towards preventing derailment. Much more might be said unfavorable to the flangeless tire. In all the four plans mentioned the objectionable features overbalance the good they accomplish. On a new six-wheeled truck, when every part is tight and close, with very little play in any part, the lateral motion is very small; therefore, when going around the average curve, or on and off side tracks, the amount of resistance is very much increased. When the flange of leading and trailing wheels of the truck are hard against the outside rail of curve, the flange of center wheel is equally as hard against inside rail of curve on opposite side. The result is the truck is subject to a strain that soon begins to show in the wear of all parts, more especially the wheel flanges and brasses.

Now to overcome this trouble, a plan is herewith presented that has been in use very satisfactorily on one of the trunk lines for five years, under some of their heaviest cars (some of which weigh over 80,000 pounds). It is simply to allow a lateral play of three-quarters of an inch in the oil boxes and pedestals of center pair of wheels. This is done by moving the guide bars *A* (see cut), on sides of box three-quarters of an inch closer together; this will permit three-quarters of an inch lateral movement of the oil boxes in the pedestals. This will allow the center pair of wheels to adjust themselves to any variation in the track required by the ordinary curves common to switches or main lines. This is a very simple arrangement involving no extra patterns or parts: the same pattern can be used for both end and center oil boxes by having two sets of pin holes for the guide bars on sides of box pattern, one set to fit close to the pedestal as required for the end boxes, the other set three-eighths of an inch nearer center to allow the three-quarter inch play required for the center boxes. The results from using six-wheeled trucks fitted in this manner are a decrease in sharp flanges, end wear in brasses, also wear of boxes on hubs of wheels.

This is not an untried experiment, but a thoroughly demonstrated plan; as there is no additional cost in applying it, it is certainly worth considering. The accompanying sketch (plan of box and section through pedestal), with one equalizing bar on and the other off, sufficiently illustrates the method described above. CAR-BUILDER.

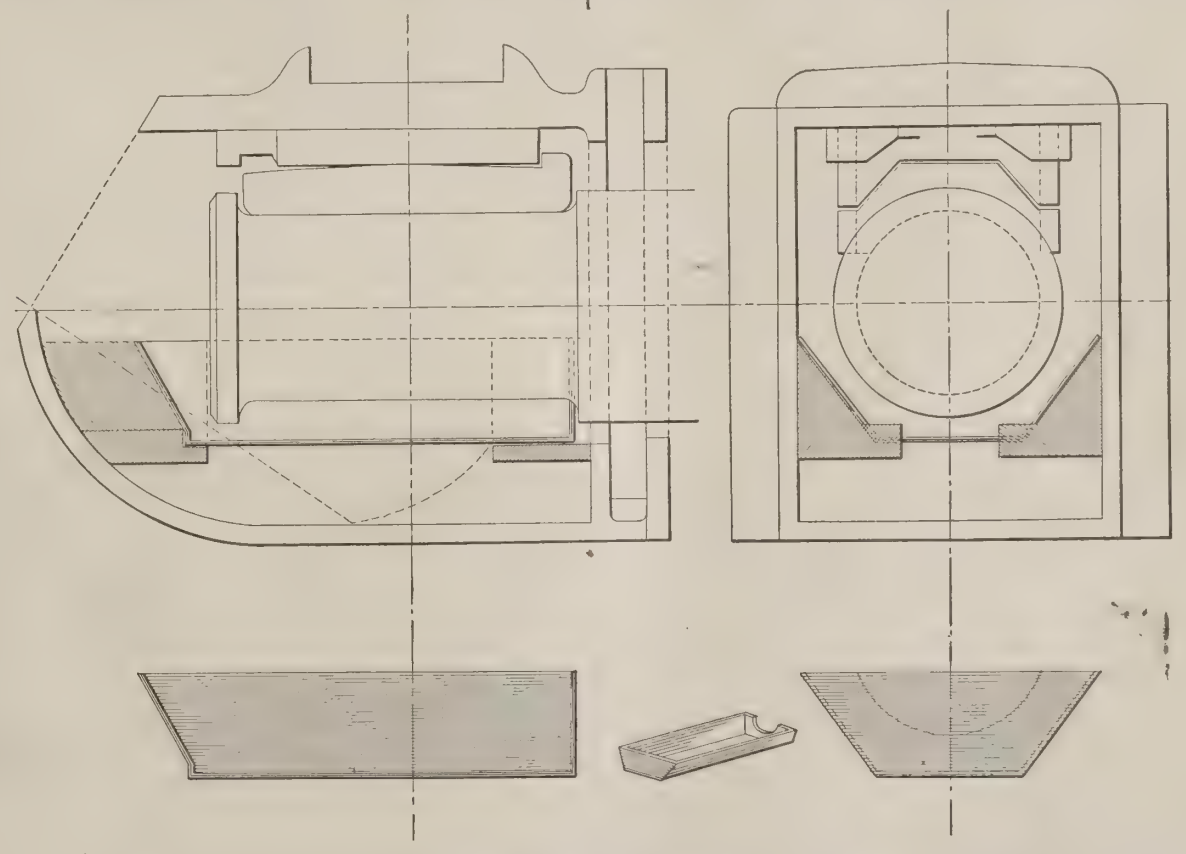
Knoxville Car Wheel Works.

The prosperity that is extending these days to so many Southern industries appears to have taken in the Knoxville Car Wheel Company, or rather, to put it correctly, the able and enterprising management of President Smith has drawn to his company a share of the good fortune waiting to be courted. There is great activity in the works, and they are furnishing castings to the numerous growing industrial establishments all over the South. They have a capacity for 200 car wheels a day, which is kept up, and in addition to this they are making 350 tons a month of miscellaneous castings. They have a blast furnace of their own in a good iron district which furnishes them with excellent iron. Besides having good iron they must have a first-class molder in charge of the foundry, for some castings made in these works, which we examined in the East Tennessee, Virginia and Georgia shops, were as fine as anything I ever saw turned out of sand.

These works have lately been extended to take in general engineering work, and Mr. N. W. Howson, who was long master mechanic of the Cumberland & Pennsylvania Railroad, and subsequently superintendent of the Eames Vacuum Brake Company, has taken charge as superintendent. They are doing all sorts of machine repairing, including the rebuilding of locomotives. A number of first-class machine tools are already at work and a full equipment has been ordered. Southern railroad companies that have not the proper facilities for doing extensive repairs on their locomotives would do well to send them to the Knoxville Works, for there they can depend on having the work done in first-class shape. The experience and ability of Mr. Howson furnish a guarantee of locomotives being put up in proper running order. A. S.

Improvement in Journal Boxes.

The improvement in journal boxes herewith illustrated has for its object to provide a simple and, at the same time, effective arrangement whereby a constant application of the waste and lubricant to the journal is assured. The tendency of oil and waste in the ordinary box being to settle away from the journal, it is claimed that the above simple device obviates that evil, and greatly lessens the liability to hot journals, as the major part of that trouble is due to this cause alone; especially is this the case in car service where cars go away from home on foreign roads and do not get the care and attention that is necessary.



It is also claimed for the device that by keeping a close application of the waste to the journal at all times it forms a perfect dust guard; instead of the waste settling away from the journal it settles toward it.

With this device it is necessary to use only one-third the usual amount of waste that is used in the ordinary box, or only that part of it from which any benefit is derived, namely, that which is on top.

The invention consists in having sloping or inclined walls, on which is placed a tray with diagonal sides for holding the waste and lubricant. This tray can be made of ordinary galvanized iron or be made of pressed steel.

This device, shown in the above illustration is being adapted to the Master Car Builders' standard box, and does not alter that box in its design, but simply adds to it in such a way as not to interfere with or cause any changes to be made.

The tray is easily removed when it becomes necessary to raise the box for the purpose of removing or replacing the journal bearing.

The device is patented by F. A. Stinard, Paterson, N. J.

Pedrick & Ayers' Works.

Railroad men are accustomed to associate in their minds Pedrick & Ayer, of Philadelphia, as being the men who provide the means of doing a variety of small mechanical operations with the least possible expense. Ingenious aids in the repairing of locomotives appear to be the specialty of the firm, but a recent visit to the works proved to the writer that the making of small articles was the smallest part of their business. They have a fine large well-arranged shop, four stories high, in Hamilton street, Philadelphia, where a business is carried on in a large scale making a great variety of machine tools. The labor-saving appliances that they manufacture for railroad companies are used in many cases in expediting work in this shop. I have been in no shop where portable tools were used more than they are here. With nearly every heavy piece of work they follow wherever practicable the policy of taking Mahomet to the mountain, and it is remarkable how often the heavy mass does not need to be moved. They have utilized electricity for transmitting small powers, and they keep a small dynamo running constantly in the engine room, which supplies power to small motors to run portable drills and similar work, besides giving the workmen lights for the examination of dark holes such as the inside of cylinders. They make connection with wires located all over the shop, and use incandescent lights for the purposes. Most shops use weeping candles or malodorous oil lamps.

I recognized in different stages of manufacture many of the special tools one gets familiar with in railroad shops and that look like the faces of old friends wherever met. The genial face of Friend Leeds gazes silently at us through the slot of his link miller; the valve seat planer brings to view the visage of an energetic foreman who, with that tool at his right hand, wrestled for months on the mission of convincing an obstinate superior that valves did not need scraping. Each and every machine brings its presiding spirit. There are several Hill valve models leaning against the wall, and I can see the energetic face of the inventor behind them talking, as if for two cents he would lick the engineer who could not be in any other way induced to interest himself in the principles of his business. The larger tools are, however, those that the proprietors take particular pride in. Above all others is their Richards improved open side planer and shaping machine, which we illustrated a short time ago. Their faith in the machine is doubtless well founded. Its extension into use is bringing it hosts of friends. This tool will work twice over a surface, finishing it at the rate of 11 square feet per minute. At the first examination one naturally fears that there must be spring to the head with its overhang, but that is not found to be the case by those who use the planer. We were shown a piece of steel which one of these planers took cuts of $\frac{3}{8} \times \frac{3}{32}$ at the rate of 18 feet per minute. This led the Midvale Steel Works to order a tool for their special work, and it is now about finished. The Northern Pacific has also ordered a planer of the same size. It is 25 inches wide and 8 feet long and has two cutting speeds. The makers are working out the designs that will adapt this tool for locomotive cylinder work. The plan of this tool appears to be particularly wel adapted to the finishing of cylinders of medium size, and there is no doubt but it will succeed with those for locomotives. It is found in practice that the double table greatl facilitates the work, for the machinist can be adjusting a new piece to one table while that on the other one is being planed.

Several other machines made by the firm have points of special excellence, the milling machine in particular.

A. S.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE,

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

NOVEMBER, 1890.

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Increase of Subscription Price.

Beginning with the first of next year, the subscription price of the NATIONAL CAR AND LOCOMOTIVE BUILDER will be two dollars a year. A first-class journal of the size and quality we are publishing cannot be produced and sold for less money than the sum named. Ever since the paper was enlarged the subscription price has fallen short of covering publishing expenses, and we only act on sound business principles in asking that our patrons should pay a fair price for what they purchase. We are engaged in making arangements for improvements that will enhance the value of the paper, and we are justified in promising that subscribers will receive full value for the increase of price.

Train Accidents and Bad Discipline.

On October 19 an express train on the Lake Shore & Michigan Southern had a remarkably narrow escape from sustaining a disaster of the kind experienced by a train on the Philadelphia & Reading six weeks ago, when over twenty persons lost their lives. A freight train was running in sections, and one section having broken in two, the next section crashed into it through the carelessness of flagmen, and some cars were derailed, fouling the other track on which an express passenger train was approaching. It was said that the engineer of the express train, seeing the obstruction too close for being able to stop, pulled the throttle open and dashed through the wreck. A great deal of sickly sentiment has been wasted in the daily papers applauding this engineer for his heroism. We think his conduct was the worst species of recklessness. We are all familiar with the dime novel species of heroic engineer who opens the throttle wide and dashes fearlessly through herds of stock and other obstructions, but we are also certain that all engineers with good sense and ordinary judgment apply the air brakes and do all in their power to reduce speed when they see an obstruction on the track, no matter how near it may be. The application of the brakes even for a few seconds greatly reduces the destructive shocks when derailment takes place.

The origin of this accident was an occurrence that has been painfully common of late, and is undoubtedly due to loose discipline among trainmen. If the officers responsible were questioned as to the cause of the accident to the freight trains they would, no doubt, spread out their schedule of rules and point out an article that had been violated. The making of good rules is all right, but the duty of railroad officers is to see that they are habitually obeyed. On some roads important rules are so regularly ignored that their presence in the book of instructions is a farce intended as a defence for the manager in case of accident. Tail end collisionsare the most common form of accident, and they generally occur through the carelessness of flagmen. On some roads flagmen are faithfully strict in the performance of their duty. As soon as a train stops on the main line, they are seen hurrying back the regulation distance with a flag no matter how straight the track may be, and how far their caboose may be seen. On other roads again the flagman never thinks of leaving the caboose until he sees a train coming. This difference on railroads is apparent to every observant person who travels. Now what is the cause of it? Is it that human nature is different on one road from what it is on another? Not at all. It is because those in charge of the trainmen on one road insist that the rules shall be obeyed at all times, and on the other the code of rules is neglected. Those in charge do not think it practical railroading to be too particular about enforcing rules at times when neglecting them will gain a few minutes of time. A smart conductor saves five minutes of time by having no flagman to call in, and the superintendent talks of him as a hustler.

The Lake Shore & Michigan Southern appears to have been earning lately a bad reputation for wrecks and irregularity of trains that result from disorganized condition in the operative departments. No traveler needs to be told how unfavorably the train service of the Lake Shore compares with that of the Michigan Central. Both roads are physically nearly alike, with the disadvantage of a long ferry against the latter line. Yet how comes it that the trains belonging to the Michigan Central are noted for their regularity while those on the Lake Shore have a different reputation? The difference undoubtedly arises from the difference in the system of management. On the former system the manager selects good operative officers and holds them responsible for results. That is management based on organization. The manager of the Lake Shore, on the other hand, attempts to supervise every detail, and his interference takes away from subordinate officers the sense of strict responsibility and tends to disorganize the service generally. The two railroads mentioned are both Vanderbilt lines and are, no doubt, subject to the same financial policy, yet they are a great contrast, so far as successful operating is concerned. The difference in results on the two lines strikingly illustrates the value of old and new methods of railroad management. The old method was for the manager to have his eye on everything, from the driving of a spike to the designing of a passenger car, from the fixing of every detail of freight rates to the supervising of the auditor's method of bookkeeping. On the modern method the manager works by organization. He plans a system that works automatically and appoints subordinates to keep the machine running smoothly. He looks to the heads of departments for results, and leaves them alone in the working out of details. All the railroads noted for successful management and exemption from accidents are managed on the latter system. The sooner that the Lake Shore falls into line the better it will be for the interests of the stockholders, and for the convenience and safety of passengers. We are afraid that a change of manager is the first requisite in the line of improvement.

Punishing Men for Efficiency.

"Mr. Brown is an excellent railroad man and I cannot part with him," was the answer made by the president of a small railroad lately to another president who had heard of Mr. Brown's ability in managing the operating affairs of a company that had maintained for years a severe struggle to make both ends meet. This was the opportunity of Mr. Brown's life, for the gentleman who sought his services was ready to increase his salary three fold and put him in a position where he would have full scope for his commanding executive ability, but the opportunity was lost through the selfish smallness of a superior who was ready to sacrifice the interests of his assistant rather than endure the small inconvenience of training a new man. Cases of this kind are not so common on American railroads as they are in the other countries, but unfortunately they happen too frequently and they are not confined to the higher branches of the railroad service either.

When a railroad man, by ability, energy and faithfulness, makes himself specially valuable in any position it ought to be the means of commending him for promotion, as his success will be an incentive to others to try and do likewise. When the officer over a man of this kind is liberal in his views, and has the best interests of railroad men at heart, he will do his best to advance the deserving man even though it should put him into the service of another company; but a superior of narrow views and contracted sympathies will hold the man to the position which he fills with success and throw obstacles in the way of change. When this policy is followed good men are often really punished for being efficient, for had they displayed less fitness for the position they were kept in they would have moved forward by routine. The selfish, narrow policy appears to work well for a time, but the really able and the finally successful manager of men develops the material he has around him by doing his best to advance the interests of every man who proves himself deserving of promotion.

Some heads of departments are famous for finding and developing good men who rise up and make their mark in the railroad world. The men who display this faculty for finding ability in others, always have men ready for every position of trust and responsibility that arises and they are generally ready to recommend men to other roads for first class positions. The roads where men of this calibre are in charge are always noted for the efficiency of all the staff high and low. The right man is always in the right place. Men running the departments of other roads are on the contrary noted for never having a competent man ready for a higher office. The subordinate officers are noted for incompetency, and general mismanagement prevails. A head of a department who does not have the judgment to select men of ability from among his subordinates or who displays a tendency to suppress those that display conspicuous capacity for the business they are engaged in, is an expensive man for a railroad company to be burdened with. When the head of a railroad company is told by the head of a department that he does not have any men capable of taking higher positions, it ought to be conclusive evidence that the department is in want of a new head.

Patent Right Claims on two-Cylinder Compound Locomotives.

Those who build two-cylinder compound locomotives in this country are likely to recive from a firm in London claims for payment of royalty, on the plea that all two-cylinder compound locomotives infringe on the Worsdell-Von Borries patents. This has been done already, and it is likely to be done again. The firm that makes the claim takes the ground that the Worsdell-Von Borries type of engine was patented, and that all who build that form of locomotive are entitled to pay the patentees the modest sum of $200 per engine. There is a belief cherished among Englishmen that Americans are famous for their assurance in making out claims on meagre basis of right; but the London firm representing the compound locomotive interests mentioned, may well be taken by their countrymen as shining examples in the unblushing effrontery with which they present claims founded on nothing. They do not claim royalty from American builders of two-cylinder compounds on the grounds that the Von Borries intercepting valve or other special patented mechanism has been used, because they know that nothing of the kind has been employed on this side, but they take the broad ground that all two cylinder compounds are imitations of the Worsdell type. If the inventor, who first put into service a successful two-cylinder compound locomotive, was entitled to royalty on the general design, the makers of the Worsdell-Von Borries compound locomotives would all be paying royalty to Mr. A. Mallet, of Paris, who designed and built this form of engine in 1876. As there appears to be considerable uncertainty among many American locomotive builders and railroad officers about the responsibility for patent royalties incurred by the use of compound locomotives, we shall briefly outline what has been done in the development of engines of this kind.

The success of the compound engine in marine and land service, directed the attention of engineers and inventors to the practicability of applying to locomotives the system of using the steam in more than one cylinder, which had produced such economical results in other lines of engineering. Various crude attempts were made in Europe and in this country to compound locomotives, but nothing productive of promising results was achieved until Mr. Anatole Mallet grappled the problem in 1876 and built three compound locomotives for the Bayonne and Biarritz Railway of France. These engines had two cylinders, high pressure on one side and low pressure on the other, made of the proportions as 1 : 2.78. The cranks were set at right angles and an intermediate receiver was employed as a receptacle for the exhaust steam. Provision was arranged for working direct steam in the low pressure cylinder when the engine was performing heavy duty. The proportions of these locomotives were not what experience proved to be the best, but the engines were put to work pulling trains and their economical performance convinced leading engineers that the compound locomotive could be made a success. The engines embraced all the essentials possessed by the most successful compound locomotive of to-day.

Two years after the Mallet compounds were put into service Mr. F. W. Webb, locomotive superintendent of the London & Northwestern Railway, converted an old locomotive into a compound on Mr. Mallet's principle. This engine worked so satisfactorily that Mr. Webb led his company into building compound locomotives extensively; but a different design was adopted. We see no reason for departing from the Mallet principle, except that the three-cylinder arrangement offered a foundation for patent rights. The original Mallet arrangement followed the line that many years of experience with compound marine and stationary engines had demonstrated to be the most successful. Tandem, three-cylinder engines and other special forms of compounds have done fairly good work on land and sea, but the engine that made the system popular was the two-cylinder compound, where the whole volume of steam used is passed undivided from a small cylinder to one of larger dimensions.

The success of the first Mallet compound locomotives led Mr. Von Borries, mechanical superintendent of the Hanover Railways, to try one in 1880. Modifications on the de-

sign were afterward introduced, and the world soon began to hear about the Von Borries compounds, which were really Mallet's design with minor additions and inconsequential changes of proportions. Not for five years later did Mr. Worsdell, locomotive superintendent of the Great Eastern Railway of England, come into the field with a compound locomotive. He followed closely after Mallet and Von Borries, but made some improvements of the valve gear, specially adapted for two-cylinder compound locomotives. He and Mr. Von Borries appeared to pool issues in making the Mallet compound a success with their own combined names attached to it, and now their agents are trying to make Amerioan locomotive builders believe that their clients have proprietary interests in all two-cylinder compound locomotives. Meanwhile the Western Association have decided that the Pitkin patents are good and infringe on nothing, and there is no reason for doubting that other inventions produced to perform similar functions will receive protection from American courts. If our friend, W. B. Mack, were to send word to the Canadian Pacific Railroad Company that they must cease making injectors, or pay him a royalty because he had certain patents on injectors, the action would be as sensible and free from audacity as the claims made by the reputed agents of the Worsdell-Von Borries compound locomotive for royalty on an invention which their clients merely helped to improve.

Temperance Among Railroad Men.

Every few weeks we hear of another railroad company having fallen in line with an order issued to trainmen intimating that the drinking of intoxicating beverages, while on or off duty, will not be tolerated, and that men known to frequent drinking resorts will be discharged from the service. The spirit that prompts the issuing of such orders is highly commendable, for it is a melancholy fact that numerous train accidents have been caused by the men in charge being made reckless or careless with liquor. No man of observant habits can mix much with railroad men, who are in the habit of indulging in the use of spir ituous liquors, without being struck by the terrible dangers of the practice. For a railroad manager to say that a trainman shall not enjoy himself in his own way and dispose of his time as he thinks proper when he is off duty seems to be an infringement of the man's natural rights; but those who are familiar with the protracted influence of intoxicants, and with the necessity for a trainman having a clear head and unclouded judgment when on duty, will admit that his condition when off duty is a matter of legitimate supervision. The writer has repeatedly, when little more than a boy, done the whole work of operating a locomotive hauling a fast passenger train while the engineer was lying in the tender unconscious with drink. He has been appalled with the reckless practices of the same man on other days when he came to duty after having enjoyed what he called a night of fun. Under other circumstances the writer has pulled heavy trains at irregular times over a single track when there was not a sober man behind the tender. He has good reason to understand the dangers of drinking habits among trainmen and to rejoice in the change of sentiment that demands sobriety.

While we zealously favor the railroad temperance crusade, we should like to see it carried on with a little more consistency. Railroad managers who issue orders against drinking ought to show an example in their own habits, and they should require the officers who are in charge of the men to practice the doctrine that is so publicly preached. Trainmen are like other human beings, and they are not likely to be impressed with the necessity for temperance and abstinence on their part when they know that the whiskey or wine bottle is an important article in every officer's car, and that other officers charged to enforce the rules of the company, visit drinking bars and indulge to their heart's content in the beverages forbidden to the lower ranks of the service. Why should a trainman be forbidden to look upon the wine when it is red or the beer that is amber when train dispatchers and others responsible for the correct manipulation of train orders are considered capable of drinking with judgment? A rule that is good for trainmen is good for all railroad men above that degree, and there will be no successful enforcement of temperance orders until this fact is generally recognized and acted up to.

A correspondent recently sent us a communication in which he commented on the illogical condition of the temperance question on a Northwestern railroad system. The trainmen are supposed to refrain from the use of intoxicating beverages at all times, yet it is a regular practice for dealers in liquors to visit the engine houses with sample cases to canvass for customers. They are said to be pretty successful in their work, and never fail to be on hand on pay day to receive payment for past deliveries and orders for a fresh supply of liquors. The head of a department who lets this kind of work go on, be it by ignorance or by connivance, is not fit to hold a position in charge of men. General managers keep bewailing the difficulty of restraining the drinking habits among their trainmen, but they generally neglect the first duty as a means of reform, which is personal example. When the heads become examples to all under them, and when they take care that their lieutenants are performing a similar duty, they may hope to find the leaven of sobriety working through the whole mass of railroad employés.

Need of Brake Piston Indicators.

So many railroad companies are putting the air brake upon their freight car equipment, that there are now few trunk railroads where through trains cannot be handled by air. This is providing the means of greatly accelerating the speed of freight trains with safety; but we find the advantage of the air brake is to a great extent lost through the miserable condition in which many of the brakes are maintained. When a railroad company incurs the serious expense of applying costly air brakes to cars it might be expected that the men in charge would make it their business to see that the brakes are kept in working order; yet, in numerous cases, the brake mechanism receives no more attention than the draw bars. The condition in which the freight car air brakes on some roads are kept was well illustrated by a train of stock cars that came under the notice of the writer. There were 17 brake cars on the train, and it was being pushed through on passenger train time. The engineer complained that the brakes were not holding, and he found it necessary to approach points as slowly as if he had to depend upon hand brakes. The other trainmen appeared to pay no attention whatever to the brakes. On reaching an inspection point the engineer mentioned to the car inspector that the brakes were not holding properly. An examination was made, and it was found that 13 out of the 17 cars had the brake pistons working up to the head.

In view of the increasing number of air brakes coming into service it is the duty of superintendents to see that their trainmen examine the brakes to see that they are in a condition to act. When brakemen and conductors are relieved from the work of applying the brakes, they ought to consider it no hardship to examine the connections and see that the automatic mechanism is in working condition. All air brakes on freight cars ought to have an indicator on to show when the piston has reached the end of its travel. There are several good devices of this kind in use that can be purchased cheaply. Where that indicator is in use there is no excuse for the trainmen permitting cars to run after the brake becomes inoperative. With a freight train it is difficult to tell how far the piston is traveling unless an indicator is used, for the engine is generally detached when the train is under inspection and the brake must be applied to show decidedly that the piston has reached the end of its travel. Had the train whose condition suggested these remarks come into collision, which it was very liable to do, the damage done would have been light if it did not cost more than the expense incurred to equip thousands of cars with the brake indicator.

Changing Size of Exhaust Passages.

It is not always safe to come to conclusions on mechanical matters by abstract reasoning. It is perfectly sound to hold that the weakest link is the strongest part of a chain, and that the weakest point in a boiler represents its limit of safety, but reasoning of that kind can frequently be carried into the realms of fallacy. We were struck with this recently on hearing a master mechanic arguing that an enlargement of an exhaust pipe of a locomotive could not assist any in preventing back pressure in the cylinders. He argued that as the exhaust tip was the limit of the steam exit, any enlargement beyond that was useless. He carried his ideas on the subject into practice by changing the enlarged form of pipe used by a predecessor, and made a gradual enlargement from the saddle opening up to the nozzle opening. If this line of reasoning were sound it would be good practice to make the exhaust passages through the saddle merely about the same section as the nozzle.

The tendency of modern practice is to make the exhaust passages through the saddle as large as possible and the application of the steam engine indicator to locomotives has done much to urge forward this improvement in design. The nozzle is certainly the ultimate gate of the emission of the steam from the cylinder, but it is not the first obstacle encountered, and if provision can be made to give a free passage to the steam as it rushes out of the exhaust port, the tendency will be to reduce the back pressure. If the exhaust pipe and the passages are of sufficient volume to hold the greater part of the steam that has passed out of the cylinder, it can have a longer time to escape into the atmosphere. This is to some extent a theory, but its soundness has been repeatedly demonstrated by practical working. We have received particulars of the improvement effected on the engines of several roads by the enlargement of the exhaust pipe. We have also seen indicator diagrams taken from engines with both small and large exhaust pipes and the difference in obstruction offered to the piston on the return stroke was very apparent, and represented what made the difference between a free running and a slow locomotive.

The necessity for having an exit to the exhaust pipe of a locomotive small enough to create a partial vacuum in the smoke box has, at the best, a bad influence on the cylinders, especially at high speeds, and the utmost care ought to be exercised to reduce the obstruction to the pistons to the smallest possible limit. Changes in the exhaust channels that are calculated to interfere with the free flow of the steam are frequently undertaken and carried out with too little thought of the results. A change that will increase the consumption of coal a pound or two to the mile cannot be detected by the engineer or fireman, but it is a very expensive change to the railroad company that has to pay the coal bills. When the enginemen fail to perceive injurious effects from a change of exhaust pipe, the master mechanic is liable to conclude that an improvement has been made. Those who contemplate effecting changes in the steam passages ought to apply the indicator before and after the alterations are made. The graphic record made by that instrument would often prove that "improvements" suggested by abstract reasoning are better to be postponed.

Do not Build Second-Class Cars.

In another column a "Car Builder" draws attention to the wretched policy followed by some railroad managers in ordering new second-class cars. It looks to us if that practice was deliberately following the policy of keeping the passenger equipment in an inferior condition. There may be railroad companies in the country that have the passenger cars of such uniform excellence that none of the first-class cars are sufficiently worn or antiquated to be converted with advantage into second-class cars, but we have not happened to come into intimate contact with them. Great improvements have been effected in passenger car building within the last few years, and there are many railroad companies that might with credit to themselves and with great extension of comfort to the traveling public convert the whole of the passenger cars into the second-class grade and purchase an entire new equipment of first-class cars. While they refrain from doing that and from effecting thorough rebuilding they have no cars that deserve the name of first class.

The fact is, many railroad companies are objectionably indifferent about the accommodation provided for travelers in ordinary day cars. The officers act on the assumption that the most genteel portion of their patrons ride in sleeping cars or parlor cars, and that the lower grades of travelers deserve no consideration. This is the worst species of short sighted policy. The people who travel in day coaches are hauled with the least expense to railroad companies; they constitute by far the largest part of the passenger business, and their comforts ought to receive the first consideration. We noticed lately that the Delaware, Lackawanna & Western had ordered a lot of new second-class cars. This road has a passenger equipment that compares very favorably with that of neighboring roads; but we have not seen any car on the road that contains all the conveniences and comforts now deemed necessary features of a first-class car. The act manifests a mistaken policy, and it is one which is too often followed. The road that provides really first-class cars keeps constantly before their patrons the best kind of an advertisement calling for business. Where the comfort of passengers receives the first consideration many of the expensive methods for capturing patronage can be dispensed with.

Progress in Favor of Compound Locomotives.

The railroad companies on this continent have been rather slow in trying compound locomotives, but now that the type has been put in service there is every indication the engines will come largely into use. The Michigan Central, which put the first successful engine of this character on the road, have ordered another compound passenger engine from the Schenectady Locomotive Works, and the latter company have just delivered a 10-wheel compound to the Atchison, Topeka & Santa Fe. The three compounds on the East Tennessee, Virginia & Georgia promise to act as successful missionaries to Southern companies of the economy on the compound principle. The Baldwin compound on the Baltimore & Ohio is running regularly against other engines and performing very satisfactory work. The same builders have lately finished a compound of similar design for a road in Mexico and they have orders from several railroads in this country for compounds. Three compounds have been built by the Rhode Island Locomotive Works for the Brooklyn elevated railroads. They are of the two-cylinder type and are provided with a valve that enables the steam to be admitted from the boiler to both cylinders. Another two-cylinder engine is under construction in the Old Colony shops at Boston.

The Southern Pacific Company have ordered from the Schenectady Locomotive Works cylinders to enable them to change an old locomotive into a compound, and it is reported that should a saving of 10 per cent. be effected, the greater part of the locomotives belonging to the system will be changed to compounds. Meanwhile we are almost daily receiving inquiries from master mechanics and other railroad officers requesting information on the subject of compound locomotives, which indicates that the spirit of inquiry is becoming very active.

Result of Letter Ballot.

The result of the letter ballot for new standards of the Master Car Builders' Association has been announced in a circular issued by Secretary Cloud. Two of the recommendations of the association have been rejected and six adopted, so that six more standards are added to the list adopted by the association. The recommendations adopted are those relating to loading logs and poles on cars; racking cars for loading bark; height of drawbar of passenger equipment cars; safety chains for passenger equipment cars; brake beam lateral angle, and fitting for train pipe for the steam heat. The recommendations rejected are: Journal boxes for cars of 60,000 pounds capacity, and lid for 40,000 pounds capacity car. We are not surprised at the result, although we think it is to be regretted that the box recommended was not adopted, for an oil box is an article that has to be renewed frequently on cars away from home, and it would be of general convenience to have such a part standard. The number of 60,000 pound cars running at large is not yet very great, and it may be that a better box than that recommended will be presented when the question comes up again, which it is bound to do very soon. The box rejected had nothing to recommend it except that it was practically of the same form and interchangeable with the present M. C. B. standard oil box used for light cars. There is a widespread impression that an improved form of oil box is something much to be desired, and many car builders believe that when a change is made an improvement ought to be effected. This sentiment no doubt led to the rejection of the box recommended by the committee.

Westinghouse Brake Instruction Book.

The Westinghouse Air Brake Company have published a new instruction book for the information of men handling their brake. The book is a remarkably compact and comprehensive production, and appears to tell everything about the brake that it is necessary for men to know. The information is crowded into 63 small pages, but the severe condensing process has left out no essential facts and the descriptions are full enough to be easily understood. The work is elaborately illustrated with excellent wood engravings which are placed in a pocket at the end of the book as is done in Phelan's Air Brake Practice. Two cards are given showing the working of the engineers valve, transparent moveable handles making the operations very plain. The book is neatly bound in leather and is of a convenient size for carrying in the pocket. It ought to be in the pocket of every engineer who handles locomotives equipped with air brakes.

Master Car Builders' Report.

We have received from Secretary Cloud the report of the proceedings of the twenty-fourth annual convention of the Master Car Builders' Association. In addition to the proceedings of the convention, good reports of which have appeared in these columns, the volume contains reports of the business transacted by the executive committee, and the decisions of the arbitration committee. It also contains the standards of the association, particulars of the letter ballot votes, and much other information that will be interesting to railroad men. The report has been very carefully edited, and the mechanical work of its production is very well done.

The special committee of the Master Car Builders' Association having in charge the investigation of how far the various automatic couplers offered to railroad companies conform to the standards of the Association, sent out notices requesting manufacturers of the car couplers concerned to send them a coupler and drawings for examination. There appears to be a singular reluctance among the manufacturers of car couplers to comply with the request of the committee, as we are informed that a very small number has sent in the information necessary for the committee. We can understand why parties making couplers that do not conform to the Master Car Builders' standard should decline to furnish couplers or drawings; but those who make couplers that agree with the standard display a densely short-sighted policy in ignoring the request of the committee. If the committee should make a report intimating that only the couplers sent them for examination could be certified to as conforming to the standard, it would have a very injurious effect upon the sale of the couplers not mentioned, and would, doubtless, incite a howl among those whose interests were affected. The car coupler men who wish to receive the official recognition of the Master Car Builders' Association had better send couplers and drawings to the committee without delay. If they fail to do so, they have no reason to complain should railroad men conclude that their couplers have no right to be classed as conforming to the Master Car Builders' standard.

Our versatile correspondent "Progressionist" distinguishes himself in another part of this issue by making a most vigorous attack upon our editorial of last month on Joint Car Inspection. He makes out a fairly good argument in favor of the Detroit plan, of which he is the champion, but that does not by any means ruin the prospects of the Buffalo plan becoming the most popular. We believed the Buffalo plan to be the most practicable and just, although in some particulars defective, and our editorial expressed the views of several master car-builders and joint car-inspectors who had given the subject much study and were in positions to judge fairly of what system was best calculated to facilitate the movement of cars and to mete out justice to all the companies concerned. Of course, we could readily trample all the vitality out of the arguments of our critic, but he means well and deserves encouragement. Then the manner in which he "sloshes" the editorial cranium is highly refreshing, and will amuse if it does not instruct the opponents of the Buffalo plan. While we are ready to treat our correspondent with the utmost forbearance, we will not interfere with any counter-irritants that may be applied by the friends of the Buffalo plan. The conflict is our friends', and we shall lean calmly in our chair and watch the wool fly. But please be careful with your missiles.

The series of articles on compound locomotives by Professor A. T. Woods, of the Illinois State University, which have been running through our columns for the last year, have been collected in book form and will be published soon by the office of this paper. The work will constitute a valuable hand-book of the compound locomotive which no master mechanic of progressive tendencies can afford to be without. The author describes the various forms of compound locomotives which have been actually used, and presents all the information necessary to guide those who have to design this type of engine. In addition to this highly useful information a great deal of data and theories respecting compound locomotives are given. Over sixty engravings are used in illustrating the book, and the essential details of compound locomotives are very clearly shown.

The joint committee of the Master Car Builders' and Master Mechanics' Associations appointed to confer about reducing the time between the conventions will meet at Buffalo on November 26, that being the date of the meeting of the Central Railroad Club. Several members of the committee are reported to be strongly in favor of recommending that the conventions be held in the fall of the year instead of in the beginning of summer. They say that the present time for holding the conventions is about the time that the summer schedules of trains are going into effect and that it is very undesirable for the head of the mechanical department to be then absent from his headquarters. Those who take this view of the case say that many more members would be able to attend the conventions in the fall than in the early summer. Others think that it would be a good plan to hold the convention of one association in June and the other in October. It is highly desirable that there should be a full attendance of members at the meeting. The Master Mechanics' committee is composed of Messrs. O. Stewart, Chas. Graham, David Clark, G. W. Stevens and John Mackenzie; and the Master Car Builders' committee of Messrs. F. D. Adams, R. L. Blackall, B. K. Verbryck, John Kirby and John Lentz.

Painting and Decorating is the new name of our old exchange, *House Painting and Decorating*. The new name is accompanied by an excellent collection of articles and of well digested information on the specialties of which this journal is the worthy exponent.

Personal.

The J. G. Brill Company, Philadelphia, request us to announce that Mr. Bernard H. Schmidt has resigned the position of western selling agent.

The numerous friends of Mr. William Wilson, late superintendent of machinery of the Chicago & Alton, will hear with sorrow that he lost his wife last month.

It is reported that Mr. J. A. Barnard, Assistant General Manager of the Cleveland, Cincinnati, Chicago & St. Louis, will perform the duties of superintendent of motive power in place of Mr. Turreff, resigned.

Mr. Abram S. Hull, for many years master mechanic of the Cumberland Valley road, and who resigned that position about a year ago, died at his home at Chambersburg, Pa., two weeks ago, aged 64 years.

Mr. W. F. Dixon has been appointed chief draughtsman of the Rogers Locomotive Works. Mr. Dixon is one of the bright young mechanical engineers brought into railroad service by the late Howard Fry.

Mr. H. Stanley Goodwin, General Superintendent of the Lehigh Valley, who has been chosen president of the Railway Superintendents' Association, will make an excellent presiding officer. This choice of a presiding officer shows that the superintendents are very discriminating in their selection.

Mr. Ross Kells, superintendent of motive power of the Erie system, has had his jurisdiction extended over the Chicago & Atlantic. Mr. Kells is now unusually busy getting the machinery of the new road put in the good condition for which easy rolling stock is now noted.

Mr. W. F. Turreff, Superintendent of Motive Power of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned. Mr. Turreff entered the service of a line that is now a part of the "Big Fours" system in 1853 as a machinist, and rose through the regular grades of gang boss, foreman, general foreman and master mechanic. He is a very pleasant and genial gentleman and has always been very popular with those working under him.

Mr. Allen S. Cooke, general master mechanic of the Chicago & Eastern Illinois, has resigned. Mr. Cooke is one of the ablest master mechanics in the country, and his management of his department was notable for energy, economy and mechanical acumen. There is no safer man in the country. Although conservative, he has always been ready to adopt admitted improvements in the design of rolling stock and in the methods of producing work economically. We offer General Manager Saul our earnest condolences on the resignation of Mr. Cooke. It is much easier to let a good man go than it is to fill his place satisfactorily.

The happy faculty of accomplishing great results in a quiet and unostentatious way has been forcibly illustrated by the management of the Baltimore & Ohio Railroad Company in establishing their numerous freight piers on our water fronts on both the Hudson and East rivers, from which they are doing such an enormous business that a fleet of some 40 odd crafts are necessary. This has been accomplished since the Arthur Kill bridge was completed, and all freight is shipped via Staten Island. The able hand and cool head of Mr. F. S. Gannon, general Eastern superintendent of the Baltimore & Ohio, is readily recognized in much of this work. The almost maidenly modesty of this gentleman leads us to refrain from further eulogism.

President R. N. Allen, of the Allen Paper Car Wheel Company, died at Cleveland, Oct. 7, of heart disease, aged 63 years. Mr. Allen was born in New England, and when a young man entered railroad life as a fireman on the Connecticut River Railroad. He advanced rapidly to the position of engineer and then moved to Cleveland, O., where he ran an engine on the Cleveland & Toledo Railroad for several years, till he was promoted to the position of master mechanic at Sandusky. After holding that place for a few years he went South as a master mechanic, which was the beginning of a very trying experience on Southern roads during the war time. After the war he left railroad life and went into the business of making straw board, which eventually directed his attention to the making of car wheels from paper. The invention was developed very slowly, and after it was perfected a formidable struggle followed in getting railroad men to believe that paper wheels were practicable. The first wheels of this material were used under a car on the Rutland & Burlington Railroad. Popular belief in the wheel developed slowly, but the energy and perseverance of the inventor overcame all the obstacles of apathy and active opposition. At last George N. Pullman became interested, and, aided by his capital and enterprise, Mr. Allen was enabled to start the Allen Paper Car Wheel Company, which now has large works at Hudson, N. Y., and Pullman, Ill. The company's ventures have proved very profitable. Mr. Allen was the first to invent a steel tire for the car wheel, and he spent several years in Krupp's works in Germany perfecting the model. He had recently devoted himself to improving paper wheels for street car service, and had a patent on a model recently introduced into practical use, besides an invention completed just before his death.

After accusing us of having once acting as an eleemosynary agent for the Salvation Army, Cy. Warman, editor of the *Western Railway*, sends a peaceoffering in the shape of a pass from New York to Denver which entitles the bearer to ride that distance on payment of the regular fare. We intend getting even with Cy., not for the Salvation Army compliment but for the wounds which our feelings and attire received when we offered the pass and got thrown off the Western express way freight. Some time we will beat our way to Denver for the purpose of calling on Cy. on his busy day, when we will start our automatic talking machine going, and keep it up at full blast till Cy. jumps ou t of the window.

Parties selling supplies to railroad men ought to be careful regarding the character and general bearing of the men whom they employ to solicit orders. Railroad companies cannot purchase goods from every firm that sends a traveler upon the road, and it is not fair that the motives of those who refuse goods should be impugned, and ins in uations made against them. Yet it is notorious that the representatives of some houses are always abusing the railroad men that do not purchase their goods, and by detestible inuendoes making people believe that corruption and not judgment is at the bottom of the refusal. When a railroad purchasing agent or other officer responsible for the selection of supplies hears the representative of a supply house insinuate that the officers of another road are corrupt, he ought to decline having any more dealings with the man.

Communications.

Why Radial Stay Bolts Fail.

NEW YORK, October 2, 1890.

Editor National Car and Locomotive Builder:

In the discussion that followed the reading of the paper read before the Northwestern Railway Club, by Mr. McIntosh, it was stated that out of twelve boilers exploded during the year, five had crown sheets supported with radial stays. This is a statement that, at this time, when the two methods of staying crown sheets are being considered, may cause many to hesitate before using radial stays.

It is generally confessed that the radial stays are the proper means of staying a crown sheet. Many master mechanics have taken up this matter and laid before their fellow master mechanics its advantages, but when doing so they have lost sight of one fact in connection with radial stays, a fact that may have caused the explosions complained of by Mr. Warren, and that is that radial stays to be effective must be properly put in. Care must be used that the threads through the two different sheets stayed are continuous, and that the thread on the stay bolt conforms to the thread on the tap; otherwise, where stay bolts are of any length, the last sheet entered by the stay bolt may strip its thread off, and all the dependence on the stay bolt must be on its riveted end. Where that occurs we might as well drive a straight rod in for a stay and rivet over the ends, and I have no doubt that if the gentleman who made the statement alluded to had examined carefully the stay bolts and the threads in the sheet, he would have found that the thread had been stripped.

This detail in radial stays is an important one, and one apt to be overlooked. We can readily see how it can be overlooked when we consider the number of threads there will be through a ⅞ sheet on a stay-bolt with 12 threads to the inch. There are but four and a half. These threads are an iron bolt passing through a steel sheet, and a very little deviation in the thread between the two sheets and the stay-bolt means destruction to that on the stay-bolt, and when the rivet on the end of the stay-bolt burns off it means destruction to the fire-box.

Care is required to do this work properly to get the benefit of it, as in everything else. Taps should be made so that the threaded portion of them, if on each end, should be cut in a lathe continuous without disconnecting the carriage of the lathe, and then of such length on each end that one part of the thread should be in the sheet while the other portion is entering the next sheet. For instance, in a crown sheet the tap, if cleared of the thread in the middle after the thread has been cut continuously, that portion of the thread on the upper end of the tap should be in the upper sheet when the portion on the lower end of the tap enters the lower sheet. When the condition of the tap is all right, then the condition of the stay-bolt must be considered, and we all know what deviation there may be in a stay-bolt, say 24 inches long, cut in a bolt-cutter, due to the expansion of the stay-bolt by the heat generated in cutting the thread, to say nothing of the difference that may be between the thread cut in a lathe, say 24 inches long, and a thread 24 inches long cut in a bolt-cutter. Any difference in the thread in the stay-bolt and the tap, when the stay-bolt is put in, means destruction to the bolt thread on one end. Defects of the above kind that are liable to occur can be compensated for by putting on the lower end of the stay-bolt inside of the fire box a nut, with a rivet outside of the nut, as many builders now do. This not only strengthens the thread by increasing its length, but also shows any defects in the stay-bolts' thread by the inability to screw on the nut.

Let me cite an instance of carelessness in the above respect.

Some few years ago, when radial stays first came into use, I was connected with a road having some locomotives built. On visiting the works building the locomotives one day, some boilers with radial stays were pointed out, and the superintendent explained how cheap he was doing the work, stating that his taps had only a thread on one end, and that the body of the tap was of a diameter equal to the bottom of the thread; that by this means, a ter one hole was tapped, the body of the tap guided the tap straight into the next hole. I was then taken to the bolt-cutter and shown a lot of stay-bolts of different lengths upset on the ends on which the threads were to be cut, and told that they cut the thread on each end by moving the bolt-cutter, after it cut one end, to the other. On being asked if they had any trouble with stripping the threads, the superintendent replied that they had not; that everything came all right. Perhaps had he had the care of these locomotives for a few years, he would have changed his mind.

When some boilers were built with radial stays for a road with which the writer was connected, stress was laid upon the fact that the thread on the stay-bolt should conform to that of the tap, and that the dimensions of the tap should be such that the threaded portions of the upper end must be in the sheet one inch after the lower portion had entered. When these locomotives were being built and the first boiler stayed, I was on hand to examine the ends of the stay-bolts, and was pleased to find that the threads were in good condition, showing that the conditions required in the tap and the stay-bolt had been complied with. When examining the bolts the thought occurred that should the stay-bolt not properly fit the sheet, there would be another evil. On hammering the ends of the stay-bolts it was found that they would shake in the hole. The work was instantly stopped and explanations made that the stay-bolts must fit properly. The firm was a conscientious one and wanted to do right, and on looking for the cause of the defect it was found to be due to the man who was putting in the stay-bolts. This man had seduced the bolt-cutter to make them small so that he would have no trouble to put the stay-bolts in. It is needless to say that he was a piece-worker, and every moment saved in screwing in the bolts increased his income. The stay-bolts were removed and proper ones put in, and although this was some eight years ago, there has been no trouble with leaking stay-bolts up to the present time.

Now, Mr. Editor, you will readily see that here are two conditions which may entirely destroy the purpose of the stay-bolt; we say entirely destroy because the rivet on the end is subject to so much deterioration in the fire box end that we can only consider it as a small factor as a stay, and after many years experience with radial stay-bolts, and a knowledge of the experience of others in this country and in Europe, who have used them, I believe that properly put in, with a nut on the fire box end properly fitting, they are the proper and most efficient stay for a locomotive boiler.

X.

Car Inspection.

Editor National Car and Locomotive Builder:

In the October CAR AND LOCOMOTIVE BUILDER a very interesting editorial appears, "Reform in the Methods of Car Inspection."

It is to be feared, Mr. Editor, that you fell among the advocates of the single man power, *i. e.*, the Buffalo plan, and that they have induced you with their soft and persuasive tongue to believe that the Buffalo plan is the only true solution of the car inspection problem. If you will go over to Detroit or place yourself in the hands of a master car builder of any of the roads interested in the joint inspection there (preferably one that is interested in both systems of inspection), I will wager you a new hat that you will thereafter swear by the Detroit plan only. Twelve months ago there was not a baker's dozen M. C. B.'s who were favorable to the Detroit plan. But since the subject has been under discussion, and its workings explained in the railway press, converts have been made until the hands shown in a test made by a Western railway paper was largely in favor of the Detroit plan.

To further show the drift of opinion: Six years ago there was but one man interested in the Buffalo and Suspension Bridge interchange that thought there was anything better than the Buffalo plan; now nearly one-half of them are favorable to the Detroit plan. No person that has once worked the Detroit plan is desirous of returning to the Buffalo plan. It is to be regretted that, judging from the tone of your editorial, you are not aware of the extent to which joint inspection is used at interchange points. There are very few that have not some system of joint inspection, either good or bad; therefore, the chances for clashing between inspectors, foremen, or even heads of departments are very much on the decrease. By joint inspection only can the interchange of cars be satisfactorily accomplished. What is now wanted is a uniform system that can be made available anywhere from a two-road junction up to the largest interchange center, not excepting Chicago. Referring to the Buffalo plan, the writer had considerable to do in the formation and working of that plan, both at Buffalo and Suspension Bridge. When it was decided to organize joint inspection at Detroit, the plan proposed and adopted was an improvement on the Buffalo plan; although but two roads were members at first, it proved to be so successful that all the roads centering at Detroit in less than a year asked to be taken into the agreement. This was over five and a half years ago. It has given such satisfaction to every department interested that the first complaint has not yet been made. Can as much be said of any other plan? The principal objections to the Buffalo plan are, first, and of most importance, the lack of thoroughness, cars being inspected by the joint system but once, and that on arrival the receiving road has no assurance that the cars are in good order when they go out, unless he inspects them at his own expense, independent of the joint inspection. It is certainly very hazardous to not make this second or outbound inspection, as has been proven quite often. In fact, where the receiving roads have their outbound yard some distance from the delivering road's yard, it has been necessary at additional expense to establish a second or outbound inspection to insure safety.

Second. The joint inspectors' duties are limited to the interchange inspection; the inspectors cannot be used for any other purpose, such as light repairs and local inspection. The railways interested must keep a separate corps of men for this.

Third. If in the second inspection a defective car is found that it is evident was overlooked by the joint inspectors (which occurs quite often, as no man is infallible), a delay is caused at once, unless the receiving road assumes the responsibility and cost of repairing the defect which is not of its own making. If it refuses to do this, and undertakes to return the car to the road responsible for the defect, it will run foul of the joint inspector, who will (and does) fall back on his record of cars inspected, and tells the complainant he has no record of defect on said car when inspected. The joint inspector in this case is the Czar, and you might as well pack your grip for Siberia as dispute him. It is within the range of possibility to go beyond the joint inspector, and take the case up with the road delivering the car, which, if fair-minded, will accept the car back and do the repairs. (This is the exception, not the rule.) The delay to the freight is serious, however, and this is where the transportation department puts an objection via the general manager's office, and the car department is in disgrace, and the system of joint inspection condemned by high authority. The foregoing is not overdrawn, but what has occurred repeatedly, and is largely the cause of the adoption of the system now in vogue at Detroit and Toledo. In the editorial referred to it is stated that by the Buffalo plan the chief inspector has general supervision over *all* the *work* done, which is a mistake. He only supervises the interchange inspection. After the inspection of incoming trains the disposition of the cars marked off is in the hands of the car foreman, who reports them to the yard master when they are ready for delivery; therefore the chief inspector's duties end where the repairer's begin.

As to the "Detroit plan," to those that are personally acquainted with its working it speaks for itself. A few words are necessary in order to correct a few errors you, Mr. Editor, ran into while at Buffalo. The joint inspector or arbitrator has full control of the interchange inspection both before and *after* delivery of cars. He also decides the responsibility for defects found in the second or outgoing inspection. The amount saved in this way to the roads interested will much more than pay the chief inspector's salary. Cars on which defects are found in the second inspection are not sent back to the delivering road for repairs, but are repaired in the yard where found, an order being given by the joint inspector on the road responsible. Can there be anything devised that will give more dispatch in handling cars at interchange points?

It is quite true that the car inspectors are not directly under the chief inspector; but they are indirectly, as the chief inspector has full control of all the interchange inspection, how it shall be done, where the line shall be drawn as to strictness as to what shall be passed or rejected. The men are directly under the car foreman of the yard where they work, the same men inspecting all incoming and outgoing trains, whether for interchange or local, and when necessary they can be used to do light repairs, which in itself often saves much delay. The advantage in this plan is evident from the fact that many interchange points, like Detroit, Toledo, Cleveland, Buffalo and Suspension Bridge, cover such a large territory that it is impossible for the chief to oversee the inspectors as they should be, hence the necessity of having some authority in each yard all the time. Therefore the plan in use at Detroit was considered to be the correct one, and has proven to be such. There is no contention between the inspectors of different roads: First, because the inspectors are in their own yard and are responsible for what is received and passed. Second. They will not knowingly pass defects for interchange, as they know full well that the inspectors in receiving yard will stop any defect they have passed, with the result that the company of the first part will have to foot the bill for the repairs. This system is a positive check on any display of personal animosity or retaliation. There is no chance for sharp practice; in fact, there is no object for any conflict, or chance for imposition, but rather an emulative tendency as to which can do the best work and place the least obstacles in the way of prompt interchange of cars.

Perhaps enough has been said to eradicate any erroneous impressions that may have got into the minds of parties not personally acquainted with the two systems under discussion.

A few words regarding the cost of maintenance of the two plans may not be out of place, as some question has arisen concerning it. It takes about the same number of men to operate either the Buffalo or Detroit plans, with the exception of a clerk, which the Buffalo plan has and the Detroit plan has not. In the former plan the duties of the inspectors are confined solely to the inspection of inbound cars for interchange; they pay no attention to outbound cars. This must be done by additional inspectors maintained by the road for whom they work, which is equal to a double set of inspectors. If there is any room for wrangling, this is where it will be found.

In the Detroit plan the same inspectors do the in and outbound and local inspection, also a large amount of light repairs, thereby saving the expense of inspectors for local and outbound cars. It does not require a very massive brain to decide which is the cheapest plan.

Finally, the suggestion made that if "the chief inspector under the Detroit plan was given direct authority over all the car inspectors a very successful system might be established." As the present system at Detroit is very successful, giving entire satisfaction to every department interested, the suggestion is certainly uncalled for.

PROGRESSIONIST.

Joint Car Inspection.

Editor National Car and Locomotive Builder:

I would like to answer Mr. Riach's criticism in your September number, but am unable to find out what he is trying to get at. In the first place, he says he is a car inspector, and signs himself a car foreman. He says J. C. is one-sided, and admits that he himself is strongly fortified in his way of thinking, especially after reading. President Briggs' inaugural speech at the Master Mechanics' Association, at Old Point Comfort: I have also read the speech, but find nothing in it to enlighten Car Inspectors, except that we are all honorable men. The authority governing a joint car inspector is as fixed as the laws of the Medes and Persians; and when an order is given through the proper authority it is as cheerfully obeyed and carried out as in any other department. Mr. Riach says that the M. C. B. rules are so replete with information, and concise in form, that there should be no question arising but what should be settled by obeying the rules; these rules, as I understand, govern all companies which are a party to them. Yet Mr. Riach says it takes two to make a bargain, and that each company has the right to dictate its own line of policy, which is certainly true to a large extent, and that is the reason joint inspection was adopted. It was not because each company did not know what they wanted, nor was it established on account of inspectors disagreeing altogether. Inspectors are the same as any other subordinates; they do as they are instructed. But the real trouble was that each company had a better opinion of their own cars and those which they were about to deliver than the company about to accept them, which is perfectly natural, as the receiving company is assuming the responsibility of the journey about to be made, and the delivery to another company at the next interchange point, while the delivering company having accepted the cars in good faith from their connections, do not wish to make repairs (especially on foreign cars) other than was caused on their line. There is certainly a large field for argument when we come to consider the vast difference of construction by the various companies, even if cars were new. The numerous grades are confusing, from the modern 60,000 capacity car to the aged ten ton, which should have been utterly destroyed years ago, but which, when the busy times come around, appear on the scene, like Bancho's ghost, and have to be disposed of. Sentiment will not do this work; it is an actual business transaction, and each car must be disposed of with a view that each decision will bear the light at any time of the superior officers' sharp inquiries.

Referring to the advantages and disadvantages between the Buffalo and Detroit systems, I would say that the position of the yards and the manner in which the yard work is done by the different companies, determine to a large extent the one best adapted for each interchange point. J. C.

Montana Union Notes.

Editor National Car and Locomotive Builder:

As Mr. Sinclair is not liable to stroll out here in the mountains, perhaps a few lines from a reader of your valuable paper will not be amiss. In the last number of the paper reference was made to the Montana Union, and the number of "general managers" it managed to get away with. It certainly has been under several different officials, but, with the exception of one, their leaving was optional with themselves.

It must be taken into consideration that though this is a small road it does a vast amount of business, consequently requiring a management with plenty of brains and ideas. The ex-general manager, W. H. Baldwin, Jr., universally acknowledged to be the best man ever holding the position, resigned to become assistant vice-president of the Union Pacific system, taking with him the good will and wishes of all. I believe one or two of his predecessors also left to better themselves; therefore it will be evident that a firing committee is unnecessary. It will be no more than just to the ex-manager and master mechanic (Mr. George Lindoff) if we note a few of the improvements this road underwent during their supervision. The first step of interest was the laying of 80-pound steel rails in place of the original 60-pound. Next was the purchase of some fine freight engines, 20 × 24 inches and 22 × 28 inches. Three of the last cylinder dimensions, when equipped for the road, weighed 120 tons (?), not decapods either. They have all been in constant mountain service and the wear is scarcely perceptible, although it has been nearly a year and a half since they came. The next important step was the erection of new brick round-houses, machine shops and offices, that will vie with any in the country. The machine shops are equipped with the very best of new machinery, which is run by a Buckeye engine. All the buildings are heated by steam and lighted with electric arc and incandescent lights; the incandescent lights are arranged so that they can be taken into fire-boxes or cabs while work is being done, which is both a neater and cleaner method than the old style Smoker torch. The former are a few of the numerous improvements completed during the present season. The master mechanic deserves a great deal of credit for the fine condition of shops, cars and engines.

L. D. SHEFFNER.

Favors Combining New and Repair Work.

Editor National Car and Locomotive Builder:

In your highly interesting article in the October number describing the fine car shop's at Fitchburg, you make mention of numerous fine tools that are in use in the planing mill, and of one tool say: "This planer is not only a particularly comprehensive machine, but it is so operated that its whole capacity can be utilized, being so strongly belted that there is no slip in making the heaviest cut. In ordinary working it planes the four sides of a 36-foot sill in 90 seconds." The performance of several other tools is highly commended, that of a Rogers' gaining machine having excited particular admiration.

There are plenty of good wood planers to be found, but that one at Fitchburg appears to be a hustler. You say it planes a 36-foot sill in a minute and a half. Now, we will not rush that machine to its utmost capacity, but will merely suppose that it finishes a sill every three minutes, which will make 20 sills an hour. According to the directory at the end of the CAR BUILDER, the Fitchburg Railroad Company has 6,388 cars. If you keep the planer at work for a month ten hours a day it appears to me that you will plane a sill for every car belonging to the company. No doubt the other tools will turn out work beyond requirements, although not so much out of proportion.

Now the question for car builders and railroad managers is, is it good policy to buy tools like those you have described for repair work alone? I answer that it is sound policy to purchase the best of everything in the market, but that they should not be confined to the doing of repair work. Good tools are costly, and no enterprising company can afford to do its repair work with inferior tools. When the good tools are on hand it seems a self-evident fact that they should be kept at work. If there is not work enough for them on repairs they should be kept going getting out stock for new cars. Persons interested in preventing railroad companies from doing their own work have kept proclaiming that it does not pay railroad companies to build their own cars till railroad officers have come to believe the thing, because it has been asserted so often. If a railroad company is crowded with the repair work and is not well provided with tools or accommodations, then it is cheaper to buy than to build cars, for necessary repairs ought never to be neglected that new work may be done; but when a company has, so to speak, a margin of means for doing new work, as in the Fitchburg case, it is better for them to do it. The talk of its being cheaper to buy than to build is a half truth and applies to exceptional cases. A railroad company that can build their own cars while keeping up repairs will find the policy much cheaper in the long run. When cars are built by a railroad company for its own use they are built to wear; when cars are built by others they are often like the peddler's shoes, that were made to sell and sold without properly soling the buyer.

Railroad managers need to consider more in a broad manner the orignal and the ultimate cost of cars. They seldom reflect about the loss to the company of keeping tools idle when they might as well be kept running and earning their interest. If cars should cost the same money when built in a railroad company's shop that a contract builder charges for them, the railroad company will always be the gainer at the end of the year of service, for the saving of repairs due to their own painstaking work will represent a good margin of profit. All contract builders are not to blame for it, but there are hundreds of cars turned out weekly that are not fit for the modern hard work jammed between the heavy locomotives of the period and run at the high speed becoming a part of freight train operating.

Wherever a correct account has been kept of the repairs of cars bought from inferior contract shops and those made by the companies themselves, the testimony has been overwhelmingly to the effect that it is economical for a railroad company to build its own cars. J. M. C.

CLEVELAND, O., Oct. 6, 1890.

Building Inferior Passenger Cars.

Editor National Car and Locomotive Builder:

The shortsightedness, or what may almost be termed the stupidity of some managements in building what is termed a cheap passenger car for emigrant or excursion business, has so often and forcibly impressed itself upon my mind that I feel called upon to ventilate my views on this subject from a car builder's standpoint. The saving over a first-class standard coach is in the character of upholstering, interior finish of the car, and possibly the lamps: total amount not to exceed $700—often not more than $500. There is not a road of any note (particularly in the Eastern States) the equipment of which is not at least 25 per cent. second class, and only fit for emigrant and summer excursion business and should be taken for this purpose, but instead of doing this they will add to this class of cars and keep their first-class grade at a standstill. It certainly is a fallacy that once shown up to a management must bring conviction with it.

CAR BUILDER.

The Superintendents' Association.

The nineteenth meeting of the American Society of Railroad Superintendents was held at the Hotel Brunswick, New York City, on October 7, morning and afternoon sessions of about two and a half hours each being held. The President of the Association, Major C. S. Gadsden, of the Charleston & Savannah, was in the chair. There are now 116 active members in the association, of whom thirty were present.

A large number of new members joined the association. The reports of the secretary and treasurer showed that the affairs of the association were in a prosperous condition.

Officers were elected for the ensuing year as follows: President, H. Stanley Goodwin, Lehigh Valley; first vice-president, R. G. Fleming, Savannah, Florida & Western; second vice-president, C. W. Bradley, West Shore; secretary, C. A. Hammond, Boston; treasurer, R. M. Sully, Petersburg, Va. Members of executive committee for two years: C. S. Gadsden, Charleston & Savannah; O. E. McClellan, Pennsylvania. For one year: O. M. Shepard, New York, New Haven & Hartford; A. B. Atwater, Chicago & Grand Trunk.

An informal report on car heating was made.

Papers were read by Mr. W. G. Wattson, of the West Shore, on The Systematic Handling and Distribution of Freight Cars, and by Secretary Hammond on Signaling. After Mr. Hammond's paper, the meeting, on motion of Major F. K. Huger, directed the president to appoint a committee on signaling, to consist of five active and two associate members. President Gadsden appointed on this committee F. K. Huger, J. J. Turner, J. Donnelly, C. H. Platt and C. D. Hammond.

At the afternoon session Mr. H. H. Westinghouse, of the Westinghouse Air Brake Company, read a paper on Recent Improvements in the Air Brake. At the close of his address Mr. Westinghouse answered a number of questions concerning the best practice. On motion of Mr. C. W. Bradley, the meeting passed a vote of thanks to the speaker. Mr. James Churchward, C. E., read a paper on Rail Fastenings and Rails, for which the meeting, on motion of Captain R. G. Fleming, passed a vote of thanks. The remainder of the session was taken up by an informal discussion on train rules various paragraphs of the [Standard Code being taken for texts.

Mr. H. F. Royce gave notice of several proposed changes in the Constitution.

Hanging Brake Beams.

At the October meeting of the Northwestern Railroad Club, Mr. Wm. H. McIntosh in the chair, a paper was read by Mr. H. L. Preston, master car builder of the Chicago, St. Paul, Minneapolis & Omaha, on the best form and method of hanging brake beams. The paper was as follows:

Wood has in the past been almost or quite exclusively the material for brake beams, and is yet used very generally for that purpose. It may be said of wood that if some attention is given to its selection it holds its own very well, in point of endurance, with the other attachments that go to make up a car brake worked by hand. Since the advent of power brakes on freight cars (considering the adjustment of connections which cannot in the nature of things receive as much attention as the brake rigging of passenger cars) it has become very important, in view of the limited movement of the power, and the likelihood of a considerable accumulation of slack at times; to eliminate this, as much as practicable, from the rods, beams etc., and confine the accumulation of slack, or loss of power, as much as possible to brake shoe wear.

The deflecting brake beam is the source of considerable loss of brake power, and the best plan of overcoming it is an important subject for consideration. Whether it will be remedied more effectually and cheaply by trussing by, or in some other manner, stiffening the wooden beam with iron or steel, or by using metal exclusively for brake beams, is the question. That iron or steel, or a combination of the two, is peculiarly adapted to the production of a non-deflecting brake beam, I think no one questions. In view of the general tendency toward the use of these materials in place of wood, where advantageous, in car construction, it would seem probable that iron and steel will very soon displace wood in brake beams. It is a feature in car construction to which the use of metal would seem particularly adapted.

There are two systems, or methods, of hanging the brake beams of freight cars: In one the attachment is to the body of the car; in the other to the truck frame. The method that secures the fairest contact of brake shoes with wheel treads, under all conditions of track curvature is, of course, the desirable one. This is not obtained in the greatest degree of permanency where the brakes are hung to the car body. Although guide pins may be used and all precautions taken to keep them in repair, it frequently occurs that the beams get out of place. Sometimes we find them so and at others we see the cuts made by the wheel flange in the brake beam, showing that it has been out of position some time. And one brake beam out of place as indicated must seriously impair the action of, if it does not render entirely useless, the brake on that car.

With the brake beams hung to the trucks there is not the same trouble. There is an advantage also in having brake beams hung to trucks, manifest, at least, to the wrecking master, who is not met with the entanglement of brake hangers and rods when seeking to extricate the body of the car from the trucks in a wreck—a difficulty usually experienced when brakes are hung to the car body.

Mr. Arthur Crandall, of the National Hollow Brake Beam Company, being called upon for his views, described several different forms of brake beams and gave particulars of the strains they could safely withstand.

Further discussion on the subject was engaged in by Messrs. Ward, Marshall, W. H. Lewis, Whitaker and Warren.

East Tennessee, Virginia & Georgia Shops.

The East Tennessee, Virginia & Georgia Railroad is well to the front among the most prosperous and best managed railroads in the South. It is doing a large and speedily increasing business, the rapid development of the naturally rich states traversed by the various lines supplying a great volume of passenger and freight business that keeps augmenting with remarkable celerity. To handle this growing traffic the rolling stock equipment has been greatly increased in number and capacity, so that the company has had a first-class road-bed, the most approved kind of cars to run over it, and locomotives of unexcelled quality to do the work. But they were like a man that had the finest kind of a wardrobe which, when out of use, was crushed into a musty, worm-eaten, ancient trunk. The weak point of the East Tennessee system has been their rolling stock workshops but the management is now preparing to change this by providing the fine shops, the ground plan of which is shown in the annexed engravings. The new shops are located three miles from Knoxville in a beautiful valley under a spur of the Cumberland Mountains. During a recent visit to the grounds I found that the walls of most of the shops were up and that some of them were roofed in. All the indications are that the buildings and their equipment will be first class in every particular.

The officers concerned believe in following the sound policy of doing all the manufacturing required for repairs at one point and providing the best of tools and skillful men to do the work. This will be the manufacturing center of the system and it promises to be among the finest to be found in the country.

At present some 200 locomotives and 6,200 cars have to be kept in running order, and it is a mystery to me how the work is done. The road is very hilly, and it is stocked with heavy locomotives that put a steady pull of twelve or thirteen tons upon the draw-bar, and doubles or trebles that in the ordinary tugs and bumps that happen when engines and cars embrace in the tumults of train service. This tries the strength of the best timber, and the finest of iron and steel often part like wax under the shocks that are considered the mere hard usage of common train service. Prairie roads would consider it remarkably uncommon service. With these severe conditions to contend with, the engines and cars of all grades work remarkably well and have the appearance of being kept up in first-class shape. How the work is done is a mystery to the ordinary observer, for the company now have the poorest apology for shops, that were always ill-designed and were intended for one-tenth of the work now turned out. The locomotive and car shops are in the same vicinity, butting into unneighborly proximity in places, and arranged originally on the plan that gives a stranger the largest number of chances of losing himself while trying to find the master mechanics' or master car-builders' office. Perhaps there was method in the madness of the design after all.

THE LOCOMOTIVE REPAIR SHOP.

In the locomotive repair shop Mr. J. B. Michael, the master mechanic in charge, has some very good tools, and all of them are kept working to their full capacity. There is one redeeming feature about the locomotive repairs—the boiler work is light. The country all around Knoxville rests on limestone foundations, beautiful marble being found in many places, yet the feed-water is not hard. The greatest call for work is on the running gear, which is rapidly worn and distorted by working around the numerous sharp curves. Great attention is bestowed upon the driving-wheel tires, and although the work is unusually hard on them they are nearly all in good condition. Every steel-tired wheel, no matter of what kind, before being put in service has the outline of tread taken with a plaster cast. This is transferred to a book kept for the purpose and other casts are taken before and after each turning. The mileage is entered along with the diagrams and a graphic history of each tire is thus kept on record. The time of going into service and the times of turning are stamped on the outside of each tire. The time that axles and crank pins were put in is also stamped on their ends, so that this record is always available.

When the driving boxes of the consolidation engines on this road had the lubricants fed through the single slot and holes on the top of the box, there was constant annoyance from driving boxes getting hot. As an experiment Mr. Michael put a slot at each side of the box about two and a half inches below the middle slot and put holes to correspond well towards the edges of the bearing. This proved such an effectual remedy against hot boxes that the plan has been adopted with all heavy engines.

They have had remarkable success in using magnolia metal in bearings, and lining of it is used for all engine truck boxes, passenger car boxes and rod brasses. The heavy freight engines on the road have such severe service to perform that a tremendous pressure is put on every inch of the main crank pin bearings, and it was almost impossible to keep the crank pins cool enough to avoid delays and accidents. Since the practice was begun of putting in the brass a lining of magnolia metal, hot crank pins have become unknown. The brass is bored out inside, leaving a small flange to hold the magnolia metal in place. The surface is trued and the metal poured in, after which the box is bored out to fit the pin. The first cost of the metal is high, but all concerned say that it is the best money-saving improvement that has been found as applied to bearings.

The rod cups on the engines belonging to this road deserve notice. They are needle cups, with an iron rail for a feeder, and the stem that screws into the strap is about 1¼ inches diameter. This is strong enough to stand a severe twist with a long wrench, which puts the cup on to stay. They have not lost an oil cup for months. Many roads are to-day sowing oil cups into their right-of-way, but it is the kind of crop where there is no harvest except it be in hot pins and ruined tempers.

They use a small rotary engine in this shop to good purpose in running the mill for boring cylinders. It is a small thing that was used as a rotary pump on a steam shovel. Steam is conveyed to it by a rubber hose, and it connects direct with the boring mill. With this power pushing it round the tool takes with ease a ⅛ inch cut. There are a variety of other labor-saving appliances used in the shops, and the foremen of each department appear to vie with each other in devising special ways of overcoming the inconveniences of the shops.

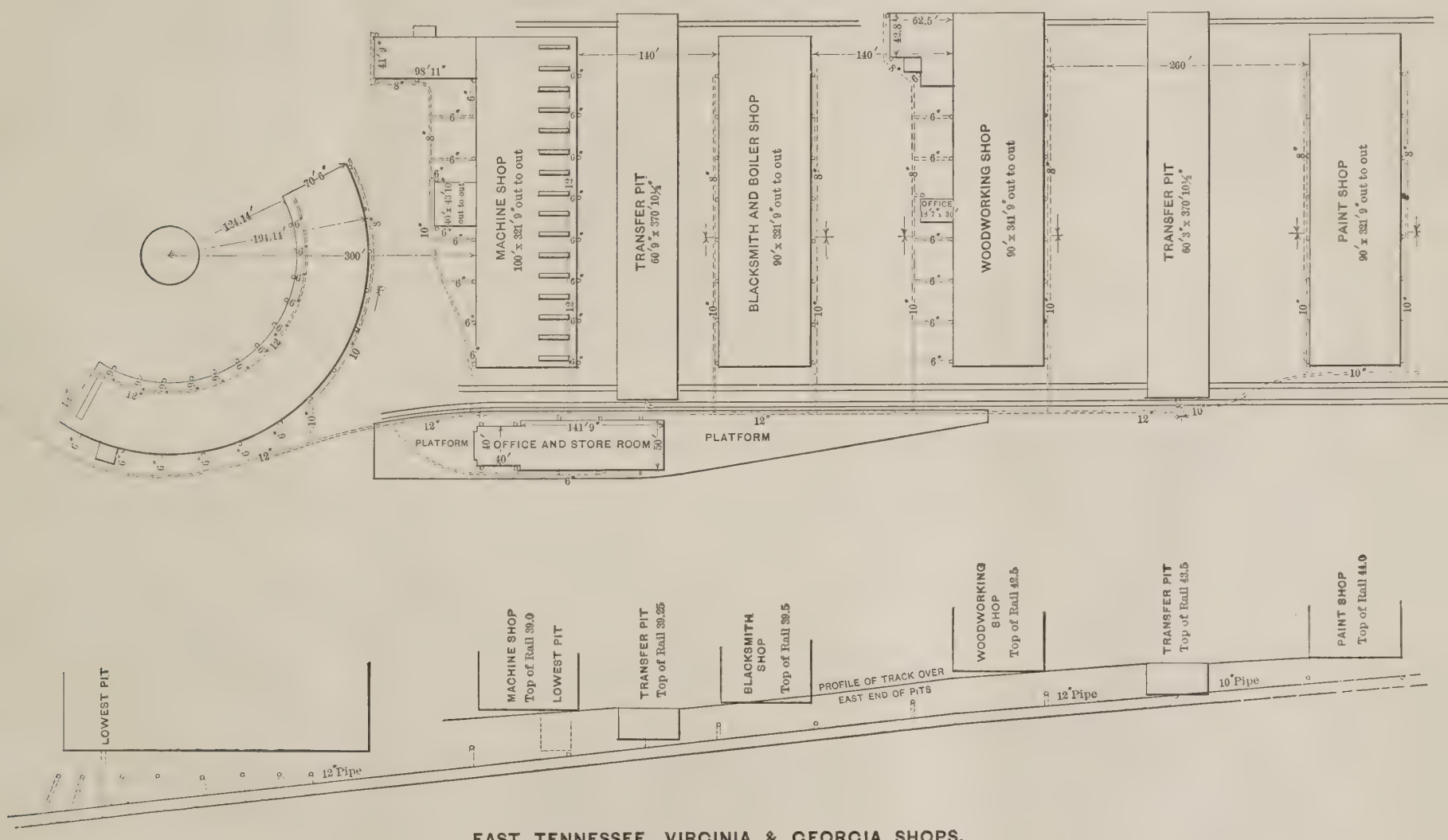
CAR REPAIR SHOPS.

Business on the road is rushing at present and it goes without saying that they are busy in the car shops. Freight car repairs is of course the principal work but Mr. J. J. Bossinger, the ever active master car builder, has lately found time to show his skill in passenger car rebuilding. The general manager's car has been remodeled, being a Phœnix-like emanation from an old Ohio Falls car. I fancy that little besides the original framing remains for the car as it now stands ready for the road will compare for elegance and comfort with any of the expensive cars that the whole resources of contract shops are strained to elaborate with luxurious trappings. This car is artistic and furnished with all comforts that are necessary in a car which constitutes the home and the office of the general manager during a considerable part of the year. The inside of the car is finished in antique oak. It has an observation room at one end and a dining room at the other, so that the party in the car can always sit behind and watch the track. The sleeping rooms are arranged similar to those in the Mann boudoir cars. It is equipped with the Consolidated Car Heating Company's apparatus and the Pintsch system of lighting is used. Arrangements are also made so that the gas can be used in the cooking stove. The windows have the gothic extension, and the car is carried on a well designed six-wheel truck, with 42-inch steel-tired wheels.

They are building a lot of their standard four-wheel cabooses, and as business permits they get out new freight cars to fill up numbers. An old sleeping car is being remodeled and will make a good day coach. There is a strong temptation upon car builders in the south to build their own cars, owing to the bountiful supply of fine timber within their reach. Where they have the proper facilities for doing the work they can probably run contract shops very close on prices. The East Tennessee, Virginia & Georgia system passes through a rich timber country and the lumber brought in from the line of the road is suitable for every requirement of car building.

They are putting the Consolidated system of heating on two trains, to give it a fair test during the winter. All new freight cars purchased or built are equipped with the M. C. B. coupler. Like other companies, they are squirming over the record of breakages, but the officers are not discouraged and think that the couplers will stand better when they are more generally in use. Great difficulty has been experienced on this hilly road in keeping freight trains from breaking in two, and very serious wrecks have frequently resulted from this cause. The train men say that the M. C. B. coupler is a decided help in keeping the trains from breaking in two. They are using Schoen pressed steel center plates and various other forms of the same material for cars, and talk very favorably of the results. I noticed that they have in use a great many hollow tubular brake beams, and Butler draw bar attachment.

Mr. Bossinger has able assistants in the persons of Mr. A. G. Anderson, foreman of the freight car department, and Wm. Ham, foreman of the car department. A. S.


MACHINE SHOP
100' x 321' 9" out to out
TRANSFER PIT
60' 9" x 370' 10½"
BLACKSMITH AND BOILER SHOP
90' x 321' 9" out to out
WOODWORKING SHOP
90' x 341' 9" out to out
TRANSFER PIT
60' 3" x 370' 10½"
PAINT SHOP
90' x 321' 9" out to out
OFFICE AND STORE ROOM
PLATFORM
PLATFORM
LOWEST PIT
MACHINE SHOP Top of Rail 39.0
LOWEST PIT
TRANSFER PIT Top of Rail 39.25
BLACKSMITH SHOP Top of Rail 39.5
WOODWORKING SHOP Top of Rail 42.5
TRANSFER PIT Top of Rail 43.5
PAINT SHOP Top of Rail 41.0
PROFILE OF TRACK OVER EAST END OF PITS
12" Pipe
12" Pipe
10" Pipe

EAST TENNESSEE, VIRGINIA & GEORGIA SHOPS.

Arbitration Committee Decisions.

The Indiana, Illinois & Iowa put a home card upon a car belonging to the Hannibal & St. Joseph, which was in a dilapidated condition, and the latter road sent bill to the carding road for the expense of repairs done. Payment was refused on the ground that the car was in general worn condition.

Arbitration committee decided that by Rule 11 the I., I. & I. were bound to report to owners the condition of car before carding it home. As this had not been done they were responsible for the cost of repairs.

The Pittsburgh & Western carded a car owing to a side door being lost, but they refused to pay the bill for the door on the curious grounds that a door was not necessary for the safe running of a car. The Detroit, Grand Haven & Milwaukee considered a door necessary, and put one on, charging the carding road with the cost.

The arbitration committee decided that the Pittsburgh & Western were responsible for the door.

The Central Georgia destroyed a car belonging to the Keokuk & Western and returned the trucks after having made some repairs upon them. The owners claimed that material foreign to the trucks had been used in making the repairs and they sent in a bill for the expense of making changes. The Central Georgia refused to pay the bill for some unknown reason.

The Arbitration Committee decided that under rules 15 to 19 the Central Georgia were entitled to pay the bill. The mystery is that any man who ever read the rules of interchange could question the responsibility of the company.

The Ohio & Mississippi charged the Peoria, Decatur & Evansville with the expense of replacing a drawbar in a carded car, and gave credit for old drawbar at the rate of three-fourths cent a pound. The latter company claimed that the credit ought to be two cents a pound.

The Arbitration Committee decided that the credit was correct.

A car belonging to the Chicago, Burlington & Northern was damaged by fire on a siding of the Des Moines Union Railway Company leading to a cooper shop at Des Moines, Iowa. The car was delivered to the Des Moines Union Railway Company by the Chicago, Burlington & Quincy Railroad Company, and the Des Moines Union Railway Company claims that the Chicago, Burlington & Quincy Railroad Company should assume the settlement with the Chicago, Burlington & Northern Railroad Company under Rule No. 27 of 1889. The correspondence shows that the track on which the car stood when damaged was not a private siding, but that it is a siding belonging to the Des Moines Union Railway Company.

The Arbitration Committee is of the opinion that as the car in question did not stand upon a private siding in the sense of Rule No. 27 of 1889 when damaged by fire, the Des Moines Union Railway Company, in whose custody the car was at the time of damage, should make settlement with the owners of the car.

The Hannibal & St. Joseph Railroad accepted from the Missouri Pacific a car for delivery to the Chicago, Burlington & Quincy, and the latter company refused it without a card because an air brake retaining valve was missing. The delivering road had to furnish the card and then they applied for permission from the Missouri Pacific to charge them with the valve, as it was proved to be missing when delivered by the Missouri Pacific. The latter company declined to become responsible for the valve, and answered that they conformed strictly to the Master Car Builders' rules of interchange.

On the case going to the Arbitration Committee it was decided, as a matter of course, that the Hannibal & St. Joseph was liable for the valve, since their men accepted the car without a card. Refusing to pay a claim which was just but which could not be enforced was a piece of sharp practice on the part of the Missouri Pacific. If the officer of the company that led to the rejection of a fair claim on mere technical grounds carries the same policy into his private affairs, those dealing with him are likely to call him dishonest.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Company destroyed two Chicago, Rock Island & Pacific box cars; in rendering bill for same the owner proposes to charge an amount in excess of the rates named as the settlement prices by the rules of interchange, claiming that the cars were of special design and intended to carry furniture, and that their original cost was, in consequence, greater than that of the ordinary box cars, the settlement for which should therefore be made under that clause of Rule No. 23 referring specially to methods of settlement for refrigerator cars, and other freight cars designed for special purposes.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Company does not agree to the proposition, and regards these strictly as box cars, differing from others only in dimensions, and not as freight cars designed for special purposes in the sense of the rules.

The Arbitration Committee say: The paragraph in Rule No. 23 relative to settlement for freight cars designed for special purposes is incomplete. It fails to clearly specify the purposes for which cars shall be used in order to be considered as designed for special purposes; neither does it establish a limit either in cost or dimensions. It is, however, evident that the framers of the rules intended, when fixing settlement prices, that one price should apply to cars of different dimensions and cost to some extent. For instance, the settlement price for a box car 32 feet long and over is fixed at $275. It is well known that box cars of greater length and size are built to carry a greater bulk of grain or other merchandise at a cost exceeding that of a box car of the minimum dimensions given for this rate, yet if destroyed the owner cannot expect in settlement a greater amount than is fixed for the smaller car. It is also reasonable to presume that in excepting some kinds of cars from the operation of the prices, those so excepted were understood to embody special features calculated to fit them to carry a class of freight for which ordinary cars are not suited, and which are not required in ordinary freight cars. Refrigerator cars contain features such as ice boxes and racks, and are specially constructed in order to secure proper insulation, and thus fit them for a purpose for which ordinary box cars cannot be used. Special cars, intended for the transportation of horses or other valuable stock, contain special features and variations in design not found in ordinary stock cars.

The committee believes that only cars possessing some of these special features can be considered as having been designed for special purposes. A car may have been designed with a view to adapt it to carry furniture, but it is available for other freight and is not confined to a special purpose in the sense of a refrigerator car. It is enlarged more with a view to increase its bulk carrying capacity than to strictly serve a purpose for which no other car would answer.

For the reason stated, the committee believes that under a fair interpretation of the rules as laid down no variation from the figures named in the rules would be justifiable.

The Sioux City & Pacific rendered a bill against the Chicago, Burlington & Quincy for repairs made on the ice box doors of one of the latter company's refrigerator cars. The latter company answered that the car had been off their lines several months, and that it was in good order when delivered to the company using it, and that the owners were therefore not responsible for the repairs made.

The Arbitration Committee sustained the position taken by the owners of the car.

The Fort Worth & Denver destroyed a foreign car accepted from the Houston & Texas Central with a defect card for three cracked sills. The former company rendered a bill against the latter company for the estimated expense of repairing the damage represented by the card. The company refused to pay the bill on the ground that the repairs which, under the rules of interchange, would form the basis for a bill were not executed.

The Arbitration Committee sustained the objection of the bill.

The Lehigh Valley Railroad Company delivered two New York, Chicago & St. Louis cars to that company with wheel flanges cracked. The Lehigh Valley Railroad Company objected to paying for the damaged wheels on the ground that the damage was caused by imperfect hanging of the brakes, causing the brakes when applied, to bear on the flange of the wheel, thereby causing it to heat and crack. The New York, Chicago & St. Louis Railroad Company claim that they have a large number of cars with the brake rigging of the same kind as on the two cars in question, and that the New York Central and Lake Shore also have a large number of cars similarly constructed, and in their experience, no such trouble results from the hanging of the brakes.

The Arbitration Committee decided that the Lehigh Valley had the right to refuse cars with brakes improperly hung and as they did not avail themselves of this privilege they were entitled to pay the charge.

The Houston & Texas Central rebuilt a stock car, destroyed on their system, belonging to the St. Louis, Arkansas & Texas. The rebuilt car was accepted by the owner without objection, but two months afterward a claim was sent in against the H. & T. C. on the grounds that the painting was improperly done and that the car had a foreign drawbar.

The Arbitration Committee held that the claim could not be sustained as the car should have been refused when offered for delivery to the owners.

Long Island City is to have a railway depot costing $500,000.

A Boston car works syndicate with $500,000 capital has decided to locate at Beaumont, Texas.

An order for 500 cars for the Western New York & Pennsylvania has been taken by the Peninsular Car Company, of Detroit.

In order to meet the increasing demands of their business, the directors of the Pratt & Whitney Company, Hartford, Conn., have voted to erect a new factory building, to be 300 by 45 feet and two stories high. Work on the new structure will commence at once.

There appears to be something radically wrong on the Louisville, New Albany & Chicago Railroad, for the fatal accidents that have happened on the road during the last six months have been simply appalling. The manager is to blame for the recurring homicides that scarcely deserve the name of accidents, and if justice were done he would be the tenant of a felon's cell.

A business meeting of the New York Railroad Club was held at the Gilsey House, New York, October 9. Arrangements were made to hold meetings monthly during the coming season. The old officers were elected. Mr. Ross Kells, superintendent motive power of the New York, Lake Erie & Western, is president, and Mr. L. R. Pomeroy secretary. The meetings will in future be held in the Gilsey House, New York.

According to the Chattanooga *Tradesman*, over 100,000 tons of rails have been received in Macon, Ga., for the Macon & Dublin railroad. Track-laying will commence at once and be pushed rapidly.

This is a rather surprising event. The road to be built is said to be 40 miles long. If the rails were 70 pounds to the yard, the quantity mentioned in the item would provide rails for more than 20 tracks.

A well informed correspondent of the New York *Sun*, writing from Berlin, says: Several weeks ago I advised you of the general opposition of German railroad men to the Carpenter brake, which is pronounced unsafe. The *Official Gazette* now admits that this brake is not all that could be wished, and adds that the Minister of Railways has always been open to reforms in this or any other direction. This announcement seems to indicate that there is a chance of the introduction of a new brake system on the German railroads.

Four towering museum cars, resplendent in polish and fantastic gilt designs, for a railroad museum, were recently built at St. Charles Car Works, St. Charles, Mo. One car is to contain the electric light plant that is to light the museum train. Another car contains the dining and culinary departments. The cars are white, with gilt designs, and have towering side-boards covered with fantastic designs. The gilding alone cost $800 per car. The idea is to run the train into a town and have the exhibition right on the cars. The four coaches cost about $24,000. The outfit is showy and novel.

The trainmen on the Georgia Central Railroad are paid by the day, and the rates of remuneration for work done are higher than those paid on any other railroad in the world, yet there is the worst kind of quarreling and dissatisfaction among the men. The engineers are noted for their kicking habits and propensities. One of their number being recently questioned as to the cause of the discordant condition of matters among the men, answered, "Well, it comes from the road being stocked with a few chronic swell-heads, who always feel like saying to the rest of mankind, get off the earth, you vermin, till I spit."

The politicians of Minnesota, as well as the daily press, are evincing just now not a little curiosity as to the strength of the Railroad Employés' Club and its probable course in the coming campaign. Its numerical strength—the number of its members and its votes—is a thing which probably no politician will know with accuracy. The club is not allying itself to any party or faction and has nothing to gain by parading its strength. Its leaders are not politicians and they are not in any "trade." What its course may be will probably be learned at the polls. The railroad employés are not bound to any party or any man. But they will hit their enemy whenever they see him, and will hoist their friend up on their shoulders. And they are finding out pretty nearly who are their enemies and their friends.—*Northwestern Railroader.*

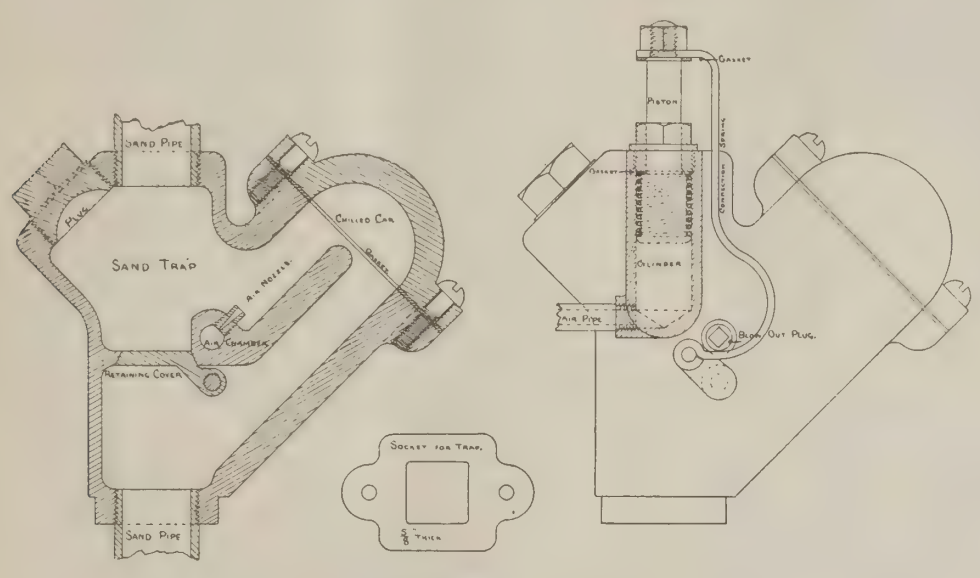
We have received from J. G. Brill Company, Philadelphia, a beautiful illustrated catalogue of the material required in the construction and maintenance of their tramway cars. The illustrations show the principal articles of woodwork, castings, forgings, car furnishings, etc., and the designs of the various forms of trucks used are made very plain. The articles are all numbered for convenience in ordering material. The catalogue will be a great convenience to those interested in the maintenance of street cars.

The engineers having charge of the construction of the large Federal street draw bridge, Boston, have decided to equip the structure with steel instead of iron wheels, and have contracted with the American Steel Car Wheel Co., of that city, to furnish them with 32 26-inch double plate all steel wheels. This is a new departure in rolling stock for bridges, but strength and safety without regard to costs seems to be their idea. The same company are also making a lot of 24-inch steel wheels for the Boston Gas Light Co. for the car trucks used in conveying coal to the retorts. The wheels are subjected to intense heat, which affects unfavorably an iron wheel. As these wheels have shown remarkable tests under heat, it is believed they will prove of value under these circumstances.

Leach's Sand Regulator.

The annexed illustrations show a track-sanding apparatus invented by Mr. H. L. Leach, Jr., master mechanic of the Fitchburg Railroad at Fitchburg. The apparatus is designed to feed a small quantity of sand in a regular and reliable manner upon the rails in front of the driving wheels of locomotives, when necessary to prevent them from slipping, and to avoid the expense of hauling the trains over large quantities of sand left on the rails when it is fed in the usual way, directly from the sand box. As only a small quantity of sand is required to prevent this slipping, if fed properly, the saving in sand thus effected is considerable, and on some roads, where good sand is hard to get, highly desirable. It is also asserted by competent authorities that the more sand that is used, the faster the rails, ties, and wheels of the train are worn out.

The object of the sand trap, which is placed in the usual sand pipe just above the running board, is to provide a small receptacle into which the sand runs when the usual sand lever is opened, and from which the sand is blown over the dividing wall by means of an air nozzle located in the trap. It has two openings at the top, either of which may be used for the sand pipe as the case requires. A cast-iron plate or socket is usually bolted to top side of the running board, into which the trap is placed, to prevent it from becoming twisted, thereby loosening the air supply pipe. A chilled cap is fastened onto the front side of the trap to receive the wear of the sand blast, and may be cheaply replaced if worn out. By removing this cap access is had to the air nozzle, which is an eighth-inch brass plug, drilled in a suitable manner. The air supplied is taken from the pipe leading from the main reservoir to the engineer's brake valve, and the supply is regulated by a feed valve of the proper construction placed in the cab convenient to the engineer. In order to prevent any moisture which might be in the air supply pipes from draining into them, the traps should be placed above the running boards, as before described, and the air pipes led upward into them, and to prevent any chance of freezing, the lowest point of air pipes, viz., where they pass under the boiler from one trap to the other, should touch the boiler or jacket, and if it should ever be considered necessary a drip pocket could be located at this point. In the dividing wall of the trap is an opening provided with a hinged cover, the natural position of which is open, and when open sand passes freely from the sand box to the rails, whenever the sand lever is opened. The retaining cover is connected to the piston of a small cylinders act onto the trap, and is closed by admitting compressed air into the cylinder through quarter-inch piping, connected with a quarter-inch plug cock located in the cab. After the retaining cover has been closed the trap may be filled for feeding. It will thus be seen that this apparatus in noways interferes with the profuse sanding of the rails to assist the brakes in making an emergency stop. The apparatus is manufactured by Mr. H. L. Leach, 237 Franklin street, Boston, and will be sent to any railroad company for trial.



LEACH'S SAND REGULATOR.

Messrs. Post & Co., of Cincinnati, O., are very busy in all their departments, more so, in fact, than ever before.

The Covey Manufacturing Company, of Chicago, have increased their capital stock from $25,000 to $75,000. They intend using the increase of capital in the building of shops with capacity to turn out ten cars a day. The company own a very valuable form of dump car that is used to a great extent for construction work and track gravelling.

The Bridgeport Machine Tool Works (E. P. Bullard, proprietor), Bridgeport, Conn., have recently issued a very handsome and complete catalogue of the machinery that they build; they are very busy on some large contracts compelling them to work overtime. They have recently added an electric light plant to their shops, which will add to their facilities for turning out their work.

The Navy Department of the United States has just awarded the contract to furnish the wood working machinery required in the Navy Yard at Norfolk, Va., to the Egan Company, of Cincinnati, O. Among the machines ordered is a complete outfit of planing, sash, door and blind machines. Preference was given to them on account of the late improvements through which better and faster work is accomplished.

The Rhode Island Tool Company, of Providence, R. I., are doing a very large business in bolts, nuts and engine builders' supplies. They have to work overtime to keep up with their orders.

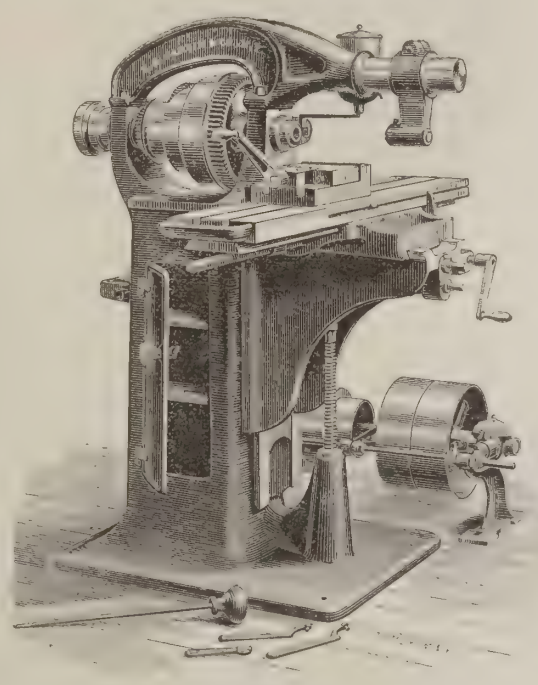
The Royal Novelty Company, of Pittsburgh, Pa., are manufacturing the inkstand illustrated herewith, that is

Novelty Ink Stand.

being used in a number of railway offices, it having the advantages of being practically unbreakable and the ink cannot be spilled, even if it is upset.

The Fox Solid Pressed Steel Company has been reorganized, and will in future be managed entirely separate from the Illinois Steel Company with which it has hitherto been closely connected. Mr. Samuel Fox, the inventor of the process, becomes president, and Mr. E. W. M. Hughes continues to hold the position of chief engineer. The headquarters of the company will be in New York, and the sales will be under the direction of Mr. James J. Brady, who is going to push the steel truck to the front among railroad managers. The manufacture of the smaller forms which have been growing into popularity lately will be continued and the business extended.

The annexed engraving represents No. 4½ milling machine made by the Garvin Machine Company, New York. The tool is very well designed and built in first-class manner and



Garvin Milling Machine.

is adapted for a great many operations in railroad machine shops.

The Berry & Orton Company, of Philadelphia, Pa., manufacturers of wood-working machinery, have under consideration the enlargement of their plant, they having about as much as they can attend to at their present quarters, Mr. Orton having recently returned from an extended trip with a number of orders, having arranged to put machinery in the shops of the Mount Vernon Car Company, the Atlanta Car Company, the Richmond & Danville Railway Company, the Lehigh Valley Railway Company, and several other large shops.

Osgood Bradley, of Worcester, Mass., is busy with some passenger cars for the New York, New Haven & Hartford Railroad.

The De-Oxidized Metal Company, of Bridgeport, Conn., are filling an order for 130 tons of their bronze castings to be used in mining work in South America; their metal being capable of resisting acids and acid water, is specially adapted for machinery used in mines.

The Schoen Manufacturing Company, formerly of Philadelphia, have removed to their new plant in Pittsburgh, where they have about four times their former capacity for manufacturing their specialties. They have added a number of new articles in pressed steel for car construction to those they have been so successful in introducing in the past. They have just issued a handsome catalogue of the various articles of their manufacture.

The Chicago agency of Messrs. Howe, Brown & Co., Limited, steel manufacturers, of Pittsburgh, Pa., formerly represented by Messrs. Winne & Jackman, will now be continued in the name of the company, with Mr. E. S. Jackman as manager. The stock of steel they will carry in their store, 228 Lake street and 18 and 20 Franklin street, will embrace all the leading sizes, and orders will meet with prompt execution. The quality will be fully up to their usual standard of excellence, and equal to any other brands of English or American steel.

We have received copies of letters written by several manufacturing concerns using tempered copper in bearings testifying very highly respecting their experience with this metal. Mr. E. W. Davis, superintendent of the Pittsburgh Traction Company, says: I have great pleasure in being able to testify to the excellent quality of your tempered copper. We have been using a guide shoe made of it on a 500 horse power Corliss engine for the past six months; it looks as well to-day as when we put it on. We are also using your metal for connecting rod boxes on a 35 horse power Ball engine, making 300 revolutions per minute. We find it takes much less oil than any other metal we have used and runs much cooler. We intend equipping all our engines with your tempered copper.

It will be of great interest and a matter of important information to the readers of this paper to know that the removal of the Westinghouse Air Brake Company from Allegheny City to Wilmerding, Pa., is now completed. The shops in Allegheny City are now occupied by the Fuel Gas and Manufacturing Company, another Westinghouse concern. A few days ago the last complement of air brake workmen left for the new shops in Wilmerding.

The general offices have also been located near the new works, while the company's city office is located in the Westinghouse Building, corner of Ninth street and Penn avenue, Pittsburgh, Pa. This building is the property of the Westinghouse Air Brake Company.

The new works at Wilmerding are now in full operation, and, owing to the increased facilities, the output of the company is now much larger than formerly.

Smallest Locomotive at Work.

H. K. Porter & Co., at their Light Locomotive Works, at Pittsburgh, have just shipped to the Otis Steel Co., of Cleveland, the smallest locomotive they have ever built. Some of the dimension of this locomotive are as follows: Cylinders, 5 inches diameter by 10 inches stroke; four driving wheels 22 inches in diameter; total weight in running order about 7,000 lbs.; two rear tanks arranged to form seats for the engineer and holding 100 gallons of water. The gauge of track is 23 inches, and the engine passes round curves of only 19 feet radius. There is no cab, as the engine is only used inside the mill. The total length of the machine is about 9 feet.

Locomotive Engineers' Convention.

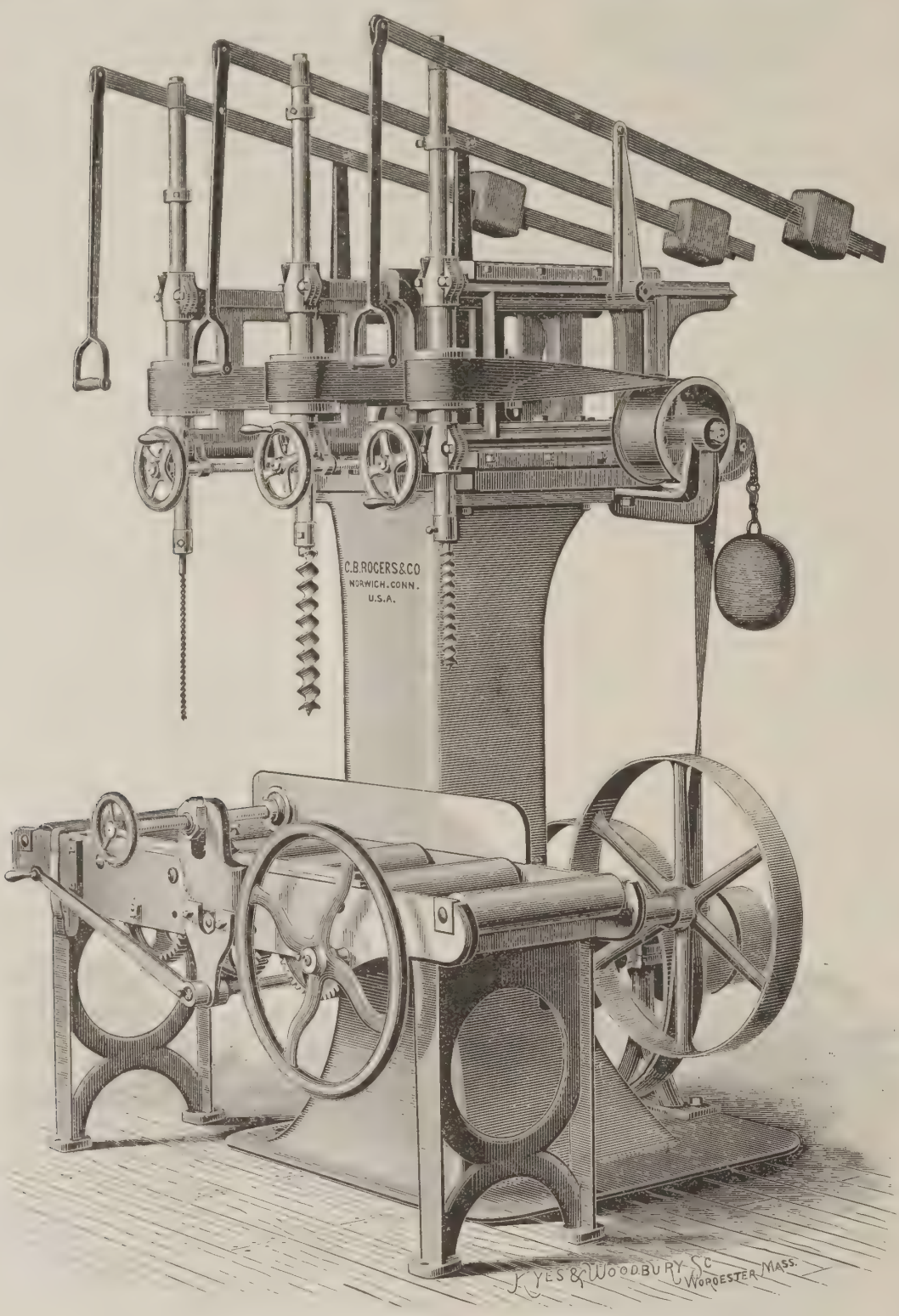
The Brotherhood of Locomotive Engineers held their annual convention at Pittsburgh last month. The most important business brought up was the proposal to federate with various other railroad organizations. This was brought up in various forms, but was always defeated. The supporters of the federation idea were nearly all from the West.

An assistant to the Grand Chief was appointed. There was a great scramble for the position, and it resulted in the choice of a man who was not a candidate. This was Mr. A. B. Youngson, of Meadville, who is an engineer on the Erie system. He is reported to be a remarkably able and conservative man. The understanding is that Mr. Arthur will resign at the end of two years, when the term for which he was elected expires, and that he will be succeeded by Mr. Youngson. The office of Past Grand Chief has been created, and Mr. Arthur will fill it under salary without active duties; but he will be consulted with should any trying occasion arise, and the Brotherhood would have the right to raise him at any time to supreme authority.

During the convention Mr. George Royal, on behalf of the Nathan Manufacturing Company, presented to the Brotherhood handsome silk American and Canadian flags, for which an illuminated vote of thanks was tendered.

Vertical Car Boring Machine.

The machine represented by the accompanying cut, recently constructed from new patterns, is designed for boring heavy timber with different sizes of holes, without the delay and trouble of adjusting the spindle or changing the bits necessary in single spindle machines. This machine has three spindles, operated by the handles connected with the weighted levers at the top, and driven by one belt from a countershaft at the back of the machine. By a heavy weight in connection with adjusting friction pulleys, the belt remains at the same tension, whatever the position of the bits. The middle spindle has a larger pulley than the other two, for slower speed to work the larger bits. Seventeen bits are furnished, varying from ⅜ to 2



VERTICAL CAR BORING MACHINE.

inches—all above 1⅝ to work in the middle spindle. The bits have a horizontal adjustment of 15 inches, and vertical throw of 16 inches.

The bed upon which the timber rests is furnished with four rollers, which can be operated by the hand wheel, or by the lever which operates the friction power feed attachment from the countershaft. The machine is built wholly of first quality iron and steel, and in the most substantia manner, thus making a useful and durable tool for all kinds of timber boring. The counter is attached to the base of the column, and is furnished with tight and loose pulleys, 10 inch diameter and 5 inch face, which should be speeded to 275 revolutions per minute.

The machine is manufactured by C. B. Rogers & Co., New York.

Mr. Henry R. Towne, president of the Yale & Towne Manufacturing Co., Stamford, Conn., announces important changes, personal, in the organization of the company. Mr. Schuyler Merritt, who has long been general manager, becomes secretary, and Mr. W. F. Donovan, well known as the company's agent in Chicago, becomes general manager. Mr. Geo. S. Redfield is appointed manager of the locks and hardware department, Mr. B. H. Warren becomes manager of the cranes, pulley blocks, hoists, etc., department. Mr. Henry H. Suplee, for years editor of *Mechanics*, takes the position of editing manager of the office, with charge of all advertising. Mr. W. H. Bryan takes Mr. Donovan's position in Chicago, and Mr. Frank H. Taylor is appointed manager of the Philadelphia house.

The Laconia Car Company, Laconia, N. H., are building 10 passenger cars for the Concord & Montreal Railway.

The Wakefield Rattan Company, of Boston, Mass., have recently furnished a number of New England railways with their car seat (Henry patents), also other roads; they are also filling large orders for car seats for railways in New South Wales and other foreign countries.

The Mount Vernon Car Manufacturing Co. are just delivering their first output of cars. They have contracts on hand for 250 box, 125 furniture, 250 coal and 200 hopper bottom cars. The capacity of the shops is 15 cars a day, and the most approved kinds of machinery have been introduced for doing the work well and to the best advantage. The company make their own wheels, and the foundry has a capacity of 120 wheels per day. The iron is melted in two Byrams Collian cupolas, and the foundry is in charge of a skillful and experienced wheel-maker. Among the machinery noticed in the establishment were some axle lathes and boring machines of Niles make, Bradley hammers, Acme bolt-heading machines, and several smaller tools made by A. B. Bowman, St. Louis. The company start out in good shape for doing their share of car building. They are putting in an electric plant to enable the shops to be worked nights as their orders for delivery are pressing.

In the course of an article on the slow burning combustion of buildings, evidently written by an expert, *Equity* says: We have just had our attention called to the fireproof paints manufactured by the National Paint Company, of Chicago. These paints contain a chemical compound discovered by one of the most celebrated chemists in France, which, being incorporated in the paint, gives it very great power to resist the action of fire; in fact, such great resistance that it renders the wood almost absolutely fireproof. Dry wood covered with these fire-resisting paints will resist ordinary flame from 20 to 40 minutes, and then only burn slowly by charring, and the flames, unless aided by other inflammable substances, will not spread or run over surfaces covered with it. Sparks, coals, oiled rags, exploding lamps, matches, steam-pipes, etc., will not set wood on fire which is covered with it. This fire-resisting compound is of such a nature that it prevents decay, and it is also one of the best wood preservatives known to chemists. We believe that we have solved this question of the best fireproof construction of buildings, and that is what is calledslow burning constuction.

The Schoen Manufacturing Company, of Philadelphia, has been engaged for about a year past building a new plant at Pittsburgh for the manufacture of pressed steel articles for car construction and other purposes. The plant has just been completed, and is now in operation. It is said to be the best arranged plant for this kind of work that has ever been built. The work is done by the hydraulic system, and the plant is provided with 13 presses of various sizes and four steam hammers. They have an immense accumulator standing 40 feet high. Some of the presses are capable of giving a pressure of 600 tons. The plant is calculated to be able to turn out 80 tons per day of pressed steel shapes. The main building is 90 × 200 feet, built entirely of iron and steel. In addition to this, they have a separate building for machine and die work, besides other buildings for stock, etc. The furnaces are of the most improved reverberatory style. The main building is floored throughout with steel. They also have built a very convenient office building near the works. The company have several new articles in pressed steel to put on the market now that they have completed their facilities for manufacturing them.

In speaking on brake beams at a recent meeting of the Northwest Railroad Club, Mr. A. Crandall said: We have recently put two of the United States testing machines in our factory, and every Westinghouse or National Hollow beam that we turn out is tested as follows: For freight service it is tested to 13,000 pounds with 3-82 inch deflection; for passenger service it is tested to 18,000 pounds with the same deflection. Every beam as it is turned out from our workmen's hands is put under these testing machines. We are now turning out about 600 beams a day, and every one is tested. Therefore we are able to guarantee that they will stand any possible pressure that you can put on them from your engine. There is one more point. You take the strut in the hollow beam; if that strut gets broken or worn from the lever pin it is made now so that you can take it out and put in a new one at the cost of the malleable iron, and it is as good as it was originally. It is made to the Master Car-Builders' standard. If it is the lever pin that is worn, we have a journal that fits in there to remedy the difficulty. There is a journal that fits in there, so that if it is worn, you can take it out and put in a new one at a cost of about three cents. In dealing with the different roads that have now adopted the beam and are using it as a standard, we have tried to use the greatest degree of care in making it as perfectly as possible, and any suggestions coming from the different roads that have it in use we are very glad to follow up, and if it is an improvement to adopt.

Our Directory.

We note the following changes during last month:

Atchison, Topeka & Santa Fe.—H. R. Nickerson, superintendent of the middle division at Newton, Kan., has been appointed general superintendent of the lines east of the Missouri River, in place of C. O. Wheeler, transferred. James Collinson, division master mechanic at Raton, N. M., has been appointed master mechanic of the Chicago division, with headquarters at Fort Madison, Ia., and Edward Hackett, of Topeka, Kan., has been appointed master mechanic at Raton, N. M.

Chicago, Burlington & Quincy.—Geo. Hargreaves has been appointed purchasing agent.

Chicago & Eastern Illinois.—A. D. Evans has been appointed purchasing agent, with office at Chicago, Ill., vice Robert Spencer. Allen S. Cooke, general master mechanic, has resigned.

Chicago, Milwaukee & St. Paul.—D. C. Cheney appointed superintendent of the La Crosse Division. R. R. Minturn, superintendent Wisconsin Valley Division. James R. Williams has been appointed superintendent of Iowa and Minnesota divisions.

Cleveland, Cincinnati, Chicago & St. Louis.—W. E. Turreff, superintendent of motive power, has resigned.

Eastern Minnesota.—Wm. McMutrie has been appointed acting master mechanic to succeed A. F. Priest, resigned.

Georgia Southern & Florida.—T. L. Sewell has resigned.

Gulf, Colorado & Santa Fe.—C. O. Wheeler has been appointed general manager, vice John Scott, resigned.

Houston & Texas Central.—L. H. Burns has been appointed Master Mechanic, vice L. C. Noble, resigned.

Illinois Central.—J. C. Ramsey, Master Mechanic at Memphis, Tenn., has been transferred to the Water Valley, Miss., shops, vice T. J. Price, deceased.

Long Island.—C. R. Fitch has been appointed Superintendent.

Louisville, St. Louis & Texas.—W. V. McCracken has been appointed general manager.

New York, New Haven & Hartford.—W. A. Waterbury has been appointed superintendent of the Shore Line Division, vice E. G. Allen, resigned. A. S. Ostrander has been appointed superintendent of the Air Line Division, vice Mr. Waterbury, transferred.

Oregon Pacific.—E. H. Dunham has been appointed superintendent at Corvallis, Ore., vice J. Stevenson.

Pittsburgh & Lake Erie.—G. A. Carr has been appointed general superintendent.

Pittsburgh & Western.—J. V. Patton has been appointed general manager, vice M. A. McDonald, resigned. Wm. Truby has been appointed superintendent Western and Lake Division, vice H. C. Boughton, resigned.

Richmond & Danville.—Chas. W. Lee has been appointed master mechanic.

Union Pacific.—James M. Barr, superintendent of the Nebraska Division, has resigned, and has been succeeded by Robert Blickensderfer. Frank Bruce has been appointed master mechanic in Kansas.

Employment.

WANTED.—A position by a man with 18 years' experience in car building, repairing, inspecting, wrecking and car cleaning. Prefers the South or Southwest. Best of references as to ability and good habits. Address B. A. J., care of this office.

NATIONAL CAR AND LOCOMOTIVE BUILDER

DECEMBER, 1890.

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Increase of Subscription Price.

Beginning with the first of next year, the subscription price of the NATIONAL CAR AND LOCOMOTIVE BUILDER will be two dollars a year. A first-class journal of the size and quality we are publishing cannot be produced and sold for less money than the sum named. Ever since the paper was enlarged the subscription price has fallen short of covering publishing expenses, and we only act on sound business principles in asking that our patrons should pay a fair price for what they purchase. We are engaged in making arangements for improvements that will enhance the value of the paper, and we are justified in promising that subscribers will receive full value for the increase of price.

The New York Chicago & St. Louis are in the market for 10 locomotives.

They are building a railroad in the Holy Land, and in future when a man goes down from Jerusalem to Jericho he will fall among Pullman palace car porters.

The Great Northern has placed an order with the Baldwin Locomotive Works, of Philadelphia, for 50 locomotives, to be used on the Pacific Coast extension.

A Three Rivers, Mich., girl has a beau who is a Lake Shore fireman. Every day she ties a bouquet to a stick and hands it to her lover as he flies by her home in his cab.

The Rushforth feed water heater has been applied lately to some locomotives belonging to the Delaware & Hudson Canal Company, and its performance is very highly spoken of.

An order has been issued on the Cleveland, Cincinnati, Chicago & St. Louis that the practice of draping engines and cabooses will no longer be permitted. It is strange that the practice is allowed on any railroad.

The New York Lake Erie & Western have recently ordered from Barney & Smith 14 day coaches and six combination cars. The coaches will be equipped with the Forney seat, and will be first-class in every particular.

The Schenectady Locomotive Works have delivered the seoond compound locomotive to the Michigan Central Railroad Company. The latest built engine of this kind is of the 10-wheel variety, and has driving wheels 62 inches diameter.

The Canada Southern Railroad is experimenting with a compound engine, of which Vice-President Cox says they get 25 per cent. more work, and which burns 25 per cent. less fuel. Two "water-scoops" are being put down, which, with the compound engines, would make it possible to cover the 250 miles from Suspension Bridge to Windsor without a stop.

The Virginia Car Works Company have been incorporated at Buena Vista, Va., with a capital stock of $1,000,000, to erect and operate car works in that place. Col. A. S. Buford, formerly president of the Richmond & Danville Railroad Company, is president of the company, with F. H. Foster, of Glasgow, Va., as vice-president and Charles Conway, secretary.

The Philadelphia & Reading Railroad Company are just finishing at the shops at Reading the fitting up of nine of its finest locomotives with steam apparatus for heating passenger cars. The engines are to be used on the Royal Blue Line on the Bound Brook division of the road. The passenger coaches of the line are being fitted up with the pipes requisite for this style of heating.

By the mistake of a telegraph operator in forgetting to send a message, President Roberts, of the Pennsylvania, missed a train to Pittsburgh and he also escaped being in a bad smash-up and probably had his life saved. In spite of this great involuntary service the operator is not likely to be promoted to an important position, for Mr. Roberts understands that men who forget to send messages are very poor stock.

The owners of railroad securities have been talking some plain unpalatable truths lately about the interference with railroads which has led to the present depression in railroad stocks. Mr. John M. Forbes, one of the directors of the Chicago, Burlington & Quincy, lately expressed himself very freely to a newspaper man. He concluded that the present depression was due to fluctuation of business, aggravated by government interference, and slightly, very slightly, by idiots who call themselves philanthropists.

There are now two American-built locomotives running on the Tokio-Kioto Railroad, in Japan, in competition with two similar English locomotives, all doing the same amount of work on a mountain grade of 132 feet per mile for 10 miles of the distance. The American machines are of the Baldwin make; the English from the shops of Nasmyth, Wilson & Co. They are running in competition to prove their respective merits. English influence dominates on the road, and some very mean things have been done to try and spoil the reputation of the American locomotives.

According to a report by E. E. Hill, secretary of the National Association of Car Service Managers, the system in vogue has resulted in reducing the general average detention of cars 68 per cent., thus saving hundreds of thousands of dollars to the railroads and improving their service. Twenty-two car service associations handled 1,220,356 cars during May June and July of this year, the average detention per car being one and a half days, while before the organization of the association it was over four days in the East and from six to eight days in the West. The general average is called five days.

Two bills in equity for the alleged infringement of six patents on air-brakes, were filed in the United States Circuit Court in New York last month, by George Westinghouse, Jr., and the Westinghouse Air Brake Company against the New York Air Brake Company and Isaac B. Newcombe, Royal C. Vilas, Charles A. Starbuck, and John C. Thompson, directors. These patents cover the Westinghouse quick-acting brake. The Westinghouse people say that the New York Company is simply appropriating their entire apparatus, and the suits are for an injunction and for an account of damages and profits.

When Mr. W. A. Scott was in Europe he noticed some curious matters in relation to trade. While in Antwerp he noticed a ship loading pig iron for Philadelphia, and on making inquiries he learned that the iron was made from ore brought from England, and that the coke used for smelting was from Connellsville, Pa. Cargoes of coke are regularly imported from America to Belgium for iron smelting. On the other hand he found in Glasgow, Scotland, a vessel being loaded with Scotch coke for San Francisco. It is certainly a curious spectacle to see America importing and exporting coke and doing it in large quantities.

Jay Gould is quoted in the *Stockholder* as saying: "Good will come out of the present depression. Some railroad managers will not feel as big as they did a few months ago. I have noticed a mellowing already on the part of a few of them. The big head is a terrible disease, and if I ever get it I hope my friends will put me in an asylum. The managers of railroads should feel themselves responsible to the bond and stockholders, and the latter will in future assert their rights in a way that will correct the evils from which they have suffered the past few years."

Mark Twain, whose forte is joking, failed to see the joke of a street car conductor in New York swearing at him even after the man offered a chew of tobacco as reparation, so Mark Twain wrote to the papers of the incident and had the man discharged. That was right. The street car conductors of New York are a hard working, patient set of men with many hardships to endure which is done cheerfully. But swearing at a humorist is one of the things the company cannot afford to tolerate in any of their men, and it is right to turn any rascal out who acts rudely because he thinks a joker is taking too much room in a car.

During a recent trip to the Pacific Coast, Mr. St. John, general manager of the Chicago, Rock Island & Pacific, was taken over the Southern Pacific, along with other railroad officials, by special train. Mr. St. John rode in his private car, which is equipped with an accurate speed indicator. During one part of the trip the train ran for 15 minutes at the rate of 68 miles an hour, and for over an hour the speed maintained was over 60 miles an hour. The car made the long, dry, sandy, fast journey without a hot box. Woolen packing is used in the oil boxes, and Mr. St. John attributes the absence of hot boxes to some extent to the use of that material, which does not sag down away from the journal.

A highly characteristic and entirely representative air brake failure was reported in connection with an accident on the New York Central last month. A freight train was being switched on the main track when the limited express passenger train was due, protected by a signal. The passenger train rushed along and the engineer did not regard the signal but kept up speed till he was nearly on the freight train; then he applied the air brakes. A collision happened, and the report made was that the air brakes failed to hold. Now, the question with us is who was responsible for the accident? Was it the engineer who ran past the signal or those who had a freight train on the main line when a fast passenger train was due?

Bathing in a Pullman is delightful in the East, where the railroads are rock ballasted and railed with heavy steel, but out West you are liable to get more fun than bath when you take a tub in the course of an average journey. The coach swings and jolts along, and you feel your way unsteadily to the tiny bathroom. The porter fills the tub, which is narrow and deep and more like a barrel than the vessels we use in our houses. Ten to one, as you sit beside the apparatus to undress, the car will strike a sharp curve, and all the water in the tub will leap out and deluge you from head to foot. If you escape that luck and get into the tub the curve and the car are certain to meet, and in an instant you find yourself in an empty receptacle, while your shoes and stockings are floating around in the lake that has covered the floor.

A new Lehigh Valley chair car of the company's own make and a large palace car in which to carry trotters, were given trials last month between Easton and Mauch Chunk. Besides having the patent couplers, the cars were also connected by a set of heavy side chains, so that in case of a separation by the coupling opening on a sharp curve, they would still be held together and also without detaching the air brake hose. While rounding the long curve at Mauch Chunk, which is one of the sharpest on the road, the side chains were tested by opening the patent couplers. The test was successful, the chains having withstood the strain without jarring the cars and without disturbing either the air, steam heat or whistle hose. It is now likely that all of the company's passenger cars will be supplied with the double-chain coupling.

The conference committee appointed conjointly by the Master Car Builders' and the Railway Master Mechanics' Associations for the purpose of devising means to draw the two association meetings closer together, met at the Iroquois Hotel, Buffalo, November 25. There were four members present from each association. Resolutions were adopted recommending the associations to change their times of meeting slightly and for both to meet at the same place, the joint executive committees to decide on the place of meeting. The Master Car Builders' Association will be requested to arrange for opening its annual convention on the second Wednesday of June, and the Master Mechanics to open on the Monday following. The conference committee unanimously recommended that the next meeting be held at New York city instead of Cape May, and the executive committees of the two associations have agreed to arrange for holding the meetings there.

Employés of the New York, New Haven and Hartford Railroad are much interested in a circular just issued by Lucius Tuttle, the General Manager, which says: "The presentation of gifts of value between officers, heads of departments, and employés generally, or the acceptance by them of gratuities from persons having or likely to have business relations with the company, is detrimental to its best interests." This notice has caused Superintendent W. A. Waterbury the loss of a $200 gold watch. Mr. Waterbury had just been transferred from the Air Line to the Shore Line division, to succeed E. G. Allen, and his friends wanted to show their appreciation of his services. The men on the New Haven road are fond of making presents. When Allen left, gifts fell in a shower about his head, and Superintendent of Motive Power Hanney has a sore trial resisting the presents that threaten him periodically. The prohibiting of employés from making presents to railroad officers might be advantageously extended to many other roads. In many cases, the practice of collecting subscriptions for presents is purely a species of blackmail.

The legal entanglements which have prevented the consummation of the plan to locate the Grant Locomotive Works at Chicago have been removed by the settlement last week of the case in the Supreme Court of Illinois. Certain parties endeavored to enjoin the sale of the land for the plant to the company at $602,000 on technical grounds. The sale is now confirmed and work will begin at once on the buildings. It is the intention to expend about $1,000,000 for a plant capable of turning out 250 engines annually. The buildings will be modeled on an entirely original plan, and so arranged that additions when necessary can be made without remodeling the original buildings. The works will be located just outside the western city limits directly westward from the business center. The company has acquired a section of land so that there will be ample room for all purposes. Mr. E. T. Jeffery, recently general manager of the Illinois Central, and Mr. George M. Bogue, well known in railroad circles, are the leading spirits of the Chicago directors of the Grant Company. Mr. Morris Sellers is a leading spirit in the company and has worked arduously to make the enterprise a success.

Union Pacific Shops at Omaha.

EDITORIAL CORRESPONDENCE.

The Union Pacific Railroad Company have lately built fine new shops at Cheyenne, Wyo., which are intended to serve as the mechanical headquarters and manufacturing center for the company. It was supposed that this movement would prove highly detrimental to the interests of Omaha, since the expectations were that the force of men employed in the Omaha shops would be greatly reduced. It may be that this consummation will come about in time, but at present there is more work going on in the Omaha shops than ever before. The work done on the road for months has been enormous. Wrecks have also been fearfully common, the result being that the capacity of these shops for repairing locomotives and cars is stretched to the utmost. The iron foundry in these shops continues to be the only one run by the company, and it is being extended to keep up with the increasing demands of the road for iron castings. Omaha has no reason to fret at present about the number of men who find employment in the Union Pacific shops.

IN THE CAR SHOPS.

During a recent visit to the Omaha shops I found Mr. A. M. Collett, master car builder, full of business, mostly in the repair line, and running his shops in the vigilant and careful fashion that has maintained him in position during the numerous official changes for which the road has been noted. The car shops here are fairly good buildings, provided with average facilities for doing work of all kinds necessary in the repairing or building of cars. While the writer was in the shops a large force was employed putting into proper shape several passenger cars that had done some running on their sides. As the rejuvenated cars emerged from the hands of the workmen it was evident that in this far western shop they had men capable of doing as fine artistic work as anything turned out of the most advanced building establishments. Some chair cars that were in the shop were fine specimens of the car builders' art. They weigh 70,000 pounds and are finished in the most luxurious fashion. They are carried on six-wheel trucks with 36-inch steel-tired wheels and heavy axles having journals $4\frac{1}{2} \times 8\frac{1}{2}$ inches. The trucks are of a new pattern and are very substantial, but the wheel base is rather long and complaints are made that the cars bind badly on curves and are hard to pull. As a partial remedy we would suggest the use of Scott's flangeless wheels in the middle. There were some passenger cars in the shop yard that have the trucks a longer distance from the ends of the car than usual. The effect of this was seen in the buffing plates which were torn as if they had grooves milled in the faces. The wear is so great that the plates have to be changed every few weeks.

This road is noted for the fine "Colonist" chair cars and sleepers. These cars are really second class cars used for emigrant business, but they are as well built as the first class chair cars, the only difference being in the inside finish. Cars of this kind are frequently engaged by parties of tourists who wish to travel comfortably and at small expense. They contain all the conveniences found in other sleepers except fine upholstery.

I noticed some new fruit cars that have been built for bringing fruit from California in fast trains. The cars are provided with means for maintaining an even temperature either by heating or cooling. The Miller platform and coupler are applied to the cars, and they are all equipped with the quick-action air brake. The company have contracted for 100 of these cars.

A novel feature about many of the baggage cars belonging to the Union Pacific is that they are provided with two doors on each side. This arrangement is made to facilitate the handling of baggage, and it is said to have resulted in material saving of time at stations.

They were fitting up a lot of stock cars with temporary middle decks for the purpose of carrying hogs. An upper deck of simple form that could be easily stowed out of the way is something greatly needed for stock cars. The writer suggested to the Union Pacific people a form of folding deck, after a plan he had seen used on ships that carried sheep; but a few days afterward he found that substantially the same thing had been patented by the Wicks Stock Car Company.

This company's passenger cars have had in use a plain form of babbitted bearing with which they have had very gratifying success. The coating of soft metal is only about three-sixteenths of an inch thick, yet the bearings usually make a very long mileage before the coating is worn through. Mr. Collett took the numbers of some of the brasses which had been removed from a car that came in for other repairs, and examined the mileage made, and it was close on 80,000 miles. After that long run the brass was just beginning to be seen through the soft metal.

They have had an electric light plant introduced into these car shops lately, and its convenience is greatly praised by those in charge. They say that the additional work got out by the men is of sufficient value to pay a good interest on the plant and the expense of running the apparatus.

The car shops are heated by steam and the water condensed in the steam pipes is returned to the boiler by overhead pipes. This is done in an ingenious manner which I have never seen employed anywhere else. The heating pipes are drained into an iron cylinder at the bottom of which the water-conveying pipe is connected. The surface of the tank is open to the heating pipes and of course has a pressure upon it equal to the pressure of steam used. This is sufficient to force the water of condensation up through the overhead pipes in the same way that the pressure of air forces up the water for washing in sleeping cars.

In the manufacturing part of the shops they prepare the glass for fancy panels with the semi-opaque, flowery appearance which is coming so much in vogue. They apply a sand blast long enough to roughen the surface of the glass and then paint it over with glue. When the glue hardens it is torn off and leaves the glass ready for use.

I noticed a useful trick used to remove hard old putty from sashes. They move the sash slowly under a jet of steam, and by the time it is gone all over the putty becomes so soft that it is easily scraped off.

They have stored in the car shops here some of the furnishings of the car that was used in carrying President Lincoln's body to Springfield. The car was built at Alexandria during the war and was afterwards bought by the Union Pacific Railroad Company. It is still used for some purpose on the road.

THE MACHINE SHOPS.

There have been very few changes of any consequence in the machine shops in the last year or two. They keep plenty of work on hand, there having been no less than 14 engines undergoing repairs when I was there. Ten engines appears to be about their regular number.

In the course of a brief visit to this shop I noticed that they were using a small portable oscillating engine for all purposes where power is needed away from the ordinary machines. They use it for boring, drilling and similar purposes, and find that it is not only very powerful, but is very economical in the use of steam.

They are having remarkably good success in using cast iron guides. I examined the guides of the Laird pattern of an engine that had been in service for seven months and found no perceptible wear.

One "improvement," I noticed was being carried out, which may prove a step backward. Many of the engines belonging to the road have equalizer tender trucks of the pattern which I have found to be the best riding truck in use, and a truck very light on repairs, although a little expensive in the first instance. In place of this they have made a strong form of diamond truck the standard. I never yet saw a diamond truck that did not ride hard, and a hard riding truck must be destructive to the roadway when carrying the constant heavy load borne by tender trucks.

They use a form of false valve seat here that has good points about it. They bore out a circular matrix on the old seat with tapered sides. The bottom of the false seat has a protuberance or boss which fits the matrix. The arrangement makes a particularly secure false seat.

Mr. Harvey Middleton, superintendent of motive power of the Union Pacific, has got out designs of a Belpaire boiler, which will be built to replace some Wootten boilers. The boiler will have a small combustion chamber, which improves the means of staying the front part of the firebox. Particular attention appears to be given to boilers in these shops. I noticed that the internal examination was very thorough, and they have a system of tests which is carried out very rigidly. The boilers are all tested at regular intervals under a hot water pressure of 200 pounds to the square inch, and care is taken to ascertain any change of form under stress.

By what appears to an onlooker as a stupid arrangement, the headquarters of the superintendent of motive power are located at Cheyenne, some 500 miles from the general offices.

This company has used steel axles more than any other western road and the material has been considered highly satisfactory so far as exemption from breakage is concerned, but they say that the journals wear faster than the journals of iron axles. The safe life of a driving axle is regarded as 400,000 miles.

They have a small shop devoted to the making of soft metal articles and to the coating of bearings. They use folding molds for making stuffing-box packing rings and numerous other forms, and the work is done very expeditiously.

The iron foundry connected with these works is one of the best managed places of the kind I have examined. Mr. John Wilson, assistant superintendent of motive power, who has charge of these shops, takes a very close personal interest in the foundry. They have been making 22 tons of castings daily. This is charged out at $1.65 per hundred pounds, and the foundry always makes a good balance of profit. They cast three engine cylinders a week, and many other castings are of an expensive form, so that the foundry must be well managed to make a profit at the low figure charged for work done. They have two cupolas close together, and they run the iron from both into one ladle, which is swung round and the metal conveniently poured into smaller ladles. They are putting up two new cupolas, one of them of Colliaus' patent form. They have just finished the construction of two new core ovens of large capacity. The foundry is very well provided with facilities for handling the metal and the castings. The cleaning department is at one end of the shop, and the castings, in moving to this point, are that distance on their way to the shipping platform.

There seems to be particularly harmonious relations existing between the various officers of these shops, a condition of affairs that has a very good influence on the economical operation of an establishment. A. S.

Aids to Inquiring Engineers.

A correspondent writes as follows, says the New York *Engineer*:

"Having had some experience in steam engineering, and wishing to study that branch to a certain extent, I make bold to ask your opinion in regard to the best book or books on that subject."

This is a very simple question to answer, so far as naming a list of works on engineering is concerned. There are innumerable books on the science of steam engineering, which, if carefully studied, will advance young men very much. One of these works is Bourne's "Catechism of the Steam Engine." It is a very old work, but it is standard of its kind, and whosoever reads it thoroughly will gain much. Another modern work is Hemenway's "Indicator Practice." Another is Sinclair's "Locomotive Engine Running and Management." Edwards' "Practical Engineers' Guide" is a useful work; so is the "Cadet Engineer;" so is "King's Notes"—in fact, the list might be so extended as to be a mere catalogue of books. But this is not our object in writing this article. We have it in mind to say something much more useful to our correspondent, and perhaps others may profit by it also. This is, that books are as much tools of an engineer as a file and chisel; and, unless he uses the books understandingly, or intelligently, let us say he will waste time and money in getting them. It is a fact that too many purchase books with the expectation that the book itself will in some way impart its information without mental exertion of the reader. They take up a work on steam engineering, turn the leaves at random, read casually here and there, and then throw the book aside. It is of no use to waste money in that way. When a young man runs across a passage or a statement that he does not understand, he should not leave it until he does; then he gains something. But if he becomes discouraged at the start, and reads no more because his first essay puzzles him, he will never rise beyond mediocrity.

Look at this illustration—it is wholly akin to the topic discussed. When a young man goes to the shop, for the first few weeks he aches in every joint of his body; he cannot do a job of any kind, but he is not discouraged, because he has determined to learn the trade; he understands that after a while his pains will disappear, and that when he has had time to learn he can do as good work as any one. It takes time to learn how to read books so as to profit by them, as Mr. Mantallini said of the labor required of him on the mangle: "It is one everlasting demnition grind," but if the grinder is determined to learn he will not mind the labor.

All books are alike in this: there is nothing new to be told. It has all been told many times before. There are no new laws and no new systems in engineering; all is the same as it has been since the world first swung in space and made 365 revolutions and a fraction per annum. But there are new ways of telling old stories, and some authors are happier than others in their treatment. Men who think clearly write clearly, and it is easy to follow their explanations of natural laws. Other men understand their subjects thoroughly but they are not gifted in expressing them, and only weary the reader who tries to follow them.

By all means read standard works, and study them attentively. The information the reader needs is between their covers, but it will not diffuse itself or become impressed upon him because his eyes see it; he must "read, mark, and inwardly digest," if he would learn from books.

A St. Louis paper of recent date says: The Cotton Belt Line sent out by its regular Texas express from the Union Depot two elegant new through coaches just turned out of the St. Charles Car Works. They were on exhibition yesterday afternoon to a select party of the clergy and laity, members of the press, etc. These cars will run through daily from St. Louis to Waco, and four more of the same design and equipment will be added to the service as soon as the finishing touches have been given at the works. They are certainly superior in construction, appearance and interior fitting to anything in the line of day coaches yet placed on the rails. The exterior panels are finished in olive, and the interior presents a bright surface of mahogany. A novel feature is the equipment with Scarrit's reversible high-back seats, which can be so arranged as to furnish accommodation for family parties of four with a table between. Another advantage is a roomy compartment at one end for smoking, fitted with five seats. The new cars are lofty and well ventilated, and the Baker system of heating by hot water is adopted, doing away with the danger of fire in case of collision.

The Brooklyn Union Elevated Railroad Company lately ran their compound engine for ten days against a lot of the best simple locomotives on the road. The coal used was all weighed. At the finish of the test the compound was found to have effected a saving of $23\frac{1}{2}$ per cent. compared with the average coal consumed by the other engines.

Delaware, Lackawanna & Western Locomotive.

The engravings on this page and the inset on 184 illustrate a locomotive which has been recently turned out of Kingston shops of the Delaware, Lackawanna & Western system. The engine is of the Wootten fire box style, designed for passenger service, and is the third of a class now being built by the above shops. These engines were designed and constructed by Mr. Chas. Graham, Jr., general foreman of these shops, under the general supervision of Mr. Chas. Graham, general master mechanic, Scranton, Pa. The engines are being used for drawing the heavy passenger trains between Binghamton and Washington Junction and burn pea or fine anthracite coal, this fuel being a very cheap quality of coal and formerly let go to waste,

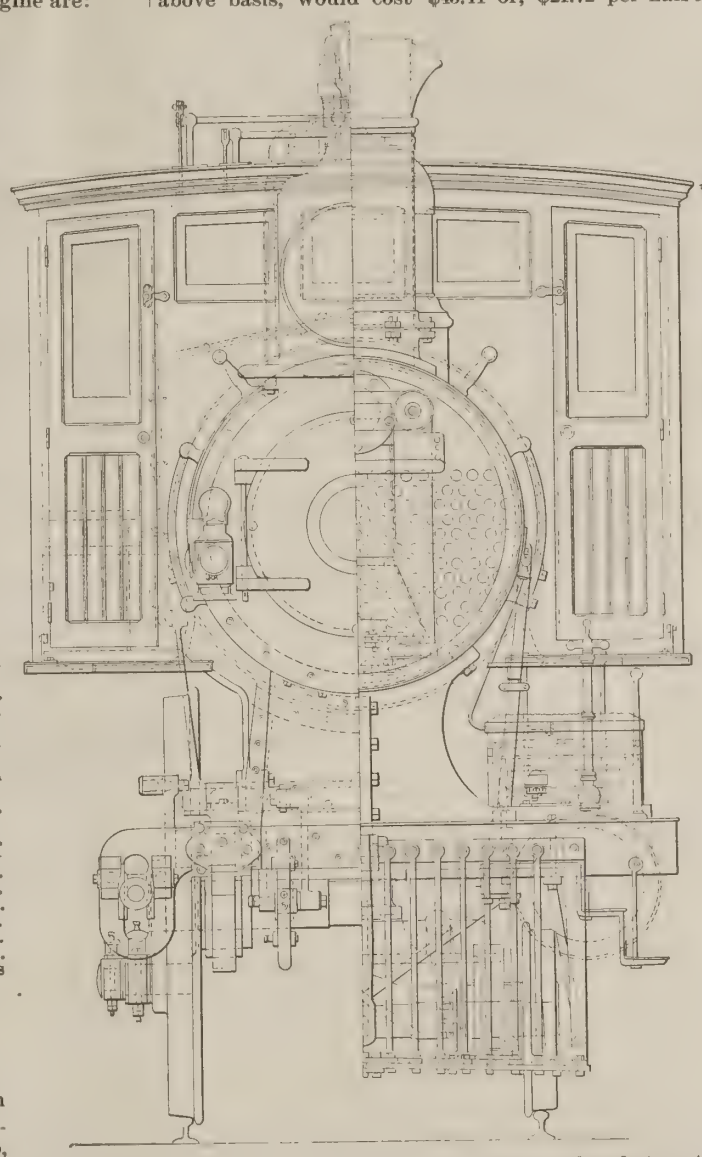
The engine is equipped with two injectors, both No. 10 Monitors, and on the right hand side of engine and within easy reach of the engineer.

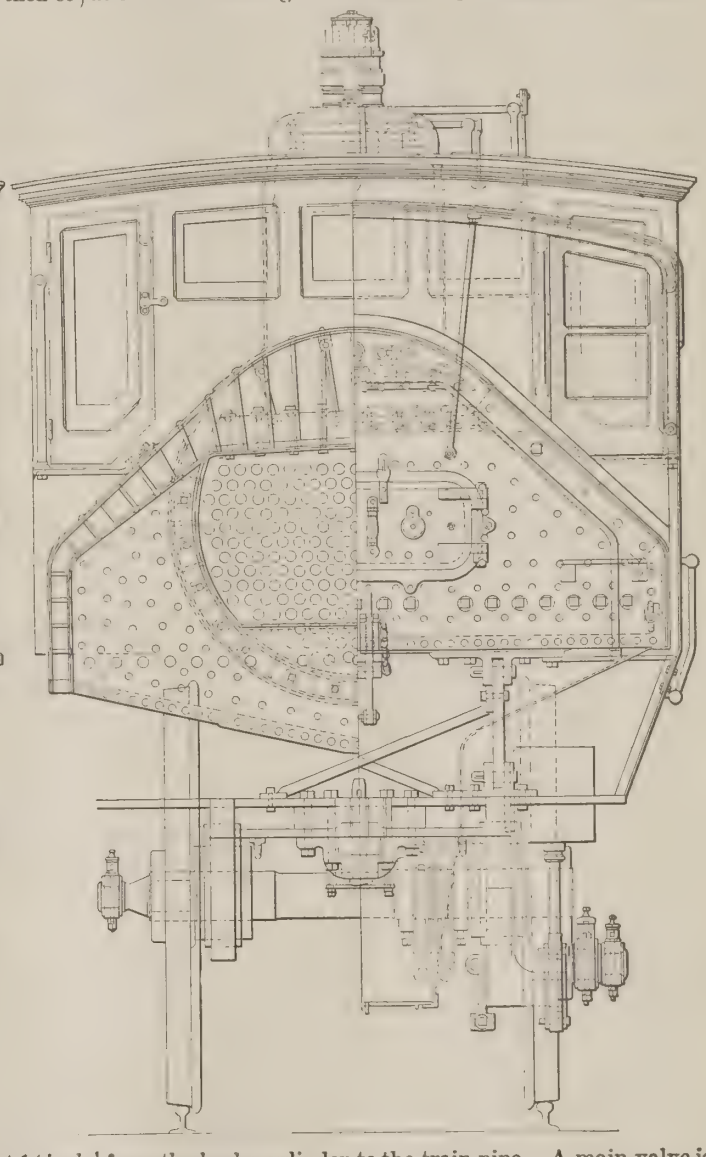
The "American Steam Brake Company's" improved driver brake is applied to the driving wheels, used with air instead of steam.

The "National hollow brake beams" are used on the tender trucks. A No. 8 Nathan cylinder lubricator is used for lubricating the cylinders. The reverse lever quadrant is notched for each 2 inches of cut off. The exhaust nozzles are double, each being 3⅝ inches diameter inside.

Some of the principal dimensions of the engine are:

CYLINDERS.	
Diameter and stroke	19 in. × 24 in.
Distance from center to center	74½ in.
Slide valve—Greatest travel	6 in.
" " lap outside	¾ in.
" " " inside	line and line.
" " lead full stroke	1-16 in.
DRIVING WHEELS.	
Cast centers	62⅜ in.
Thickness of tire	3½ in.
Axles, steel, journals	8 in. dia., 10 in. long.
Distance from center to center	8 ft. 6 in.
Engine truck wheels, steel tire, "Boies patent"	
Engine truck axles—steel	
" " " journal	6 in. dia., 10 in long.
Distance from center to center	5 ft. 8 in.
Total wheel base of engine	22 ft. 9½ in.
Tender truck wheels, steel tire, "Boies patent"	
Tender truck wheels, diameter	36 in.
" " axles, steel	
" " " journals, collarless with brass and key	4 in. dia., 8 in. long.
Guides	steel.
Cross heads, cast steel, with cast iron gibbs babbited.	
Boiler—	
Diameter from flue sheet	54 in.
" largest course sheet.	60¾ I. D.
All horizontal seams with double row of rivets and welt inside.	
Thickness of plates (excepting dome course ½ in.)	7-16 in.
Height of center from rail	8 ft. 1½ in.
Top of stack from top of rail	14 ft. 10 in.
Fire box, Spang steel—	
Length inside	10 ft.
Width "	8 ft.
Tubes, semi-steel—	
Number	216.
Diameter, O. D	2 in.
Length	11 ft. 6 in
Heating surface—	
Tubes, external	1,300 sq. ft.
Fire box, including combustion chamber	169 sq. ft.
Total	1,469 sq. ft.
Grate area	80 sq. ft.
Weight in working order	110,000 lbs.
" on driving wheels	77,600 lbs.
" on engine truck	22,400 lbs.
Working pressure	140 lbs. per sq. in.
Capacity of tank	3,600 galls





Tire Fastening.

At the October meeting of the Western Railway Club Mr. G. W. Rhodes, superintendent of motive power of the Chicago, Burlington, read a paper on Steel Tired Wheels and the principles to be followed in attaching the tire to the center. He began by alluding to the developments which made improvements in rolling stock necessary, and to some of the causes which urged important changes forward. The increasing acceleration of train speeds made it highly desirable that a safer method of tire fastening than that of shrinkage alone should be introduced for locomotive driving tires. Breakage of tires is becoming very common. On the Chicago, Burlington and Quincy, with 469 locomotives, there were 13 broken tires during the year ending June 1, 1890. Detailed particulars of the breakages were given. The paper was illustrated by a variety of etchings and photographs of broken parts.

"You are doubtless all familiar," continued the author, "with the St. George bridge disaster, which occurred in Canada in 1889, and which was attributed directly to a broken tire. Fortunately there are as few fatal accidents from broken tires as there are from broken journals. The subject, nevertheless, is deserving of the most serious consideration."

THE ORDINARY LOCOMOTIVE TIRE FASTENING.

In this country the almost universal method of securing driving wheel tire to centers is to depend upon no other fastening than the shrinkage of the tire. At the twentieth annual convention of the Master Mechanics' Association held in 1887, tire gauges with allowances for shrinkage based on about one one-hundredth of an inch to the foot were adopted and are now the recognized standard. It is a question, however, whether with the increased speeds and weight on drivers of recent engine construction a more secure fastening than merely shrinking on the tire should not be used. The practice on many lines is to make from 1⅛ to 1⅝ the limit in thick ess for the last turning of driving wheel tire. On some lines with more recently constructed express engines, this limit is raised to two inches. As tires get thin, the blows they are subjected to in service sometimes results in, if we may so call it, an imperceptible hammering out or enlargement which causes the tire to become loose and slip. The initiative has already been taken by some of the eastern lines, of securing their driving wheel tire with retaining rings. If the breakage of the tire could be remedied by simply increasing the limit for thickness at last turning, the demand for new fastening would not be so apparent. The experience on most lines, and which seems to be confirmed in the table and tire sections already presented to you, is that tire is as liable to break when but half worn out as when more nearly reaching the limit at which they are allowed to run.

ADVANTAGE OF RETAINING RINGS.

Let us consider some figures in connection with securing tire with retaining rings. It is expected by some that with retaining rings it is practicable to get one-half inch more wear from a locomotive tire than if shrunk on by the ordinary method. A 3-inch flanged tire for a 62-inch center will average 1,057 pounds in weight; at 4¾ cents per pound (old price) its value would be $50 21. For convenience in calculating, let us assume that it will be condemned at 2 inches. Two-thirds of the original weight would be 705 pounds, which, at a scrap value of $19.20 per ton, would be worth $6.77.

Cost of tire	$50.21
Deduct scrap value at 2 inches thick	6.77
	$43.44

The one inch that would be worn off, therefore, on the above basis, would cost $43.44 or, $21.72 per half inch of wear. Any device which will enable railroads to get ⅛ inch more service out of its tire, they can afford to spend $21.72 for per tire without its costing any more than it may now be doing, under the shrinkage plan, besides the advantage of greater security during the whole life of the tire. Assuming that a tire will give 10,000 miles to the sixteenth of wear, ⅛ inch additional wear would be equivalent to 80,000 additional miles before the tire has to be removed, or 5,000 miles a month, or 16 additional months service.

Regarding engine truck and tender wheels, he found that those fitted with steel tires were rapidly coming into use and attributed it to the reduced prices at which they have been placed on the market, and which has been brought about by the reduction in the cost of tire during the last year. If then, he said, any large number of steel tired wheels are to get into service it will be well to consider carefully the principles that should be observed in attaching the tire to the center.

Allusion was made to the great variety of methods of fastening tires, and the author considered the decision as to which form of fastening was best a most important problem. Specimens were shown of bolts securing steel tired wheels, having been sheared after the wheel began to work loose. Illustrations were given of a tender tire that came off from this cause when the engine was pulling a passenger train at a speed of 48 miles an hour. The conclusion of the paper was as follows:

Cases of bolt shearing doubtless occur more or less frequently, but for various reasons seldom come to the surface. The fact that many inventors herald their product as coming under the heading of "boltless wheels" shows clearly that what has been said on this feature of fastenings is well recognized by those who have made the subject a study. If it be granted then that in shrinking on tires of small diameter, as with those of large diameter, misfits may be made, and also that when worn thin, even what was a perfect fit originally is liable to slip through the enlargement of the tire by hammering or by heating for brake application, it must be apparent that the best form is one which secures the tire to the center in a manner that will allow a slip of the tire without any shearing strain being brought on the fastener. In other words, the fastener should be circumferential with the tire and not at right angles to it. Our belief is that this principle should be observed in locomotive driving wheels as well as in the truck or car wheels.

A new air brake for railway cars has been invented and patented by Mr. Leonidas Guellemet, of San Francisco. The object of the invention is stated to be mainly to obtain rapid and nearly simultaneous action of all the brakes in a train, both in ordinary and in emergency stops, to secure steadiness and even holding power, and to provide the means of rapid release of all the brakes on a train. To perform these functions valve mechanism and arrangements are employed making common connection of the brake-cylinder with the train-pipe and the auxiliary reservoir, and also a direct and separate connection of the brake-cylinder with the train-pipe whereby the train-pipe pressure is brought down in the initial movement of the valve mechanism by turning a portion of the air into the brake-cylinder at each car to set the brakes, and is in like manner raised in the operation of releasing the brakes, by returning pressure from the brake-cylinder to the train-pipe. A main valve is so combined for operation with ports and passages of the auxiliary reservoir, brake-cylinder and train-pipe of each car that a slight reduction of train-pipe pressure through the engineer's valve on the engine is sufficient to open communication between each brake-cylinder and the train-pipe at the beginning, and thereby quickly and uniformly operating the valve that controls connection between auxiliary reservoir and brake-cylinder. Through the ports and passages between the brake-cylinder and the train-pipe the pressure is returned again to the train-pipe at the first movement in releasing the brakes for the purpose of bringing up the pressure throughout the entire length of the train-pipe quickly, and thereby accelerating the action of the exhaust-valve, instead of making its initial movement depend on the refilling of the train-pipe throughout the train from the main reservoir on the engine. In connection with this valve mechanism there is arranged a direct connection valve controlling ports and passages of larger area between the train-pipe and brake-cylinder independently of the auxiliary reservoir and its valve, the object of which is to use the full available pressure in case of an emergency, when the brakes are to be quickly applied with greatest power. Combined and co-operating with these parts and mechanism is a releasing-valve operated by air-pressure applied from the train-pipe and from a supplemental reservoir on the car, these parts being controlled through the main or setting valve and connected parts to release the brakes promptly and with economy with the consumption of air.

In a monthly report of engines on the Grand Trunk R. R., the average consumption of coal was 121.6 pounds of coal per square foot of grate surface per hour.

Railway Car Construction.

BY WILLIAM VOSS.

Twentieth Paper.

PASSENGER CAR TRUCKS.

The American passenger car body is mounted in the same manner as the freight car body, that is on two center-bearing trucks. The number of wheels in each truck is four if the weight of the car does not exceed 50,000 pounds; for heavier cars six-wheeled trucks are employed, and in some exceptional cases trucks with eight wheels have been resorted to.

The majority of passenger cars are still being run on chilled wheels of the same diameter and weight as those used for freight service. Of late years, however, steel-tired wheels have been largely introduced and principally for the reason that they are more safe; but there are other reasons that make them desirable for this service, the principal among which is that they are less noisy, owing to their being more elastic than chilled wheels, which latter also accounts for the fact that trucks equipped with them are less troublesome to keep in order. The better classes of cars, like sleeping cars, etc., where expense is a secondary consideration, are therefore usually mounted on steel-tired wheels.

The manner in and the materials of which these wheels are constructed made it possible to increase the diameter; and large diameters improve the riding qualities of a car and also tend to reduce the journal friction, thus making hot boxes a less frequent occurrence. The majority of steel-tired wheels are 42 inches, this being the largest size practicable to introduce, as the distance between the rails and the bottom of the car cannot very well be increased, and even with this size it is necessary to locate the intermediate sills of the floor frame in such a manner that they do not come in the path of the wheels.

There are, however, a large number of steel-tired wheels of 33 or 36 inch diameter in use, principally under old equipment that was arranged for this size, but also under much new work, both to avoid the changing of existing standards of construction and out of consideration of first cost, which advances in direct proportion as the diameters.

The axles, journals, journal boxes and bearings are usually of the forms and dimensions as adopted by the Master Car Builders' Association for cars of 40,000 pounds capacity, and where a difference is maintained this does not generally affect these dimensions.

As the journal box of a passenger truck is made to work in a pedestal instead of being rigidly attached as it is in a freight truck, its exterior must of necessity be altered to meet this condition. The correct form of this, as established by the association referred to, is shown in Fig. 146.

The frame of a passenger truck is a much more elaborate and expensive affair than that of the ordinary freight truck, the high rate of speed at which it is hauled and the comfort and safety of the passengers demanding the best that can be devised. The great difference in the appearance and the construction of the two trucks is due to the employment in the passenger truck of two sets of springs, one of which is placed under the swing beam or truck bolster in the usual manner and the other is interposed between the truck frame and beams resting on the journal boxes. This arrangement does not alone give the truck the proper elasticity required, but also cushions its frame, which without this, as it is quite heavy and made up of so many parts, would be difficult to maintain.

There is only one style of passenger truck frames in existence now, the other varieties which were introduced at different times having been practically abandoned at this writing; it is therefore not necessary to consider any other than the one in question. Referring to Figs. 141 to 148, inclusive, which show the general arrangement and details of the four-wheel truck selected for the purpose of description, the frame consists of two side or wheel pieces, two end pieces, two transoms and four axle safety beams, all of which are of wood, usually white oak, although hickory is in some instances employed. The wheel beams are 4½ inches thick and 9½ inches wide at the center and 6½ inches at the ends, the top edge being curved; their length over all is equal to the length of the frame, which is 10 feet 8 inches. This dimension is suitable for a truck having the very common wheel-base of 7 feet and 33-inch wheels; trucks equipped with 42-inch wheels have usually an 8 feet wheel-base and measure 12 feet 6 inches over the frame. The back of the wheel beam is grooved, as shown, to receive a ¾-inch square truss rod which, as it passes through and secures the end pieces, avoids the use of the troublesome joint bolts; the ends of the rods are threaded for ⅞-inch nuts, and cast-iron washers of about 3-inch diameter are provided to insure ample bearing on the wood.

A large number of passenger trucks are now being built with a plated wheel beam like that shown in the example of six-wheeled trucks; the beam is in that case usually 7 inches wide and parallel, both top and bottom edges being straight; the thickness is as before, that is 4½ inches, including the two iron plates, of which the outer is ¼ inch and the inner ⅜ inch. The plates are secured to the wood filling by a number of ½-inch button-headed bolts in addition to the pedestal and other bolts passing through them.

The end pieces are 4 × 6 inches set on edge; their length is 4 inches greater than the width of the frame which, as this truck is fitted with standard axles and pedestals, is 6 feet 7¼ inches. They are mortised to receive tenons cut on

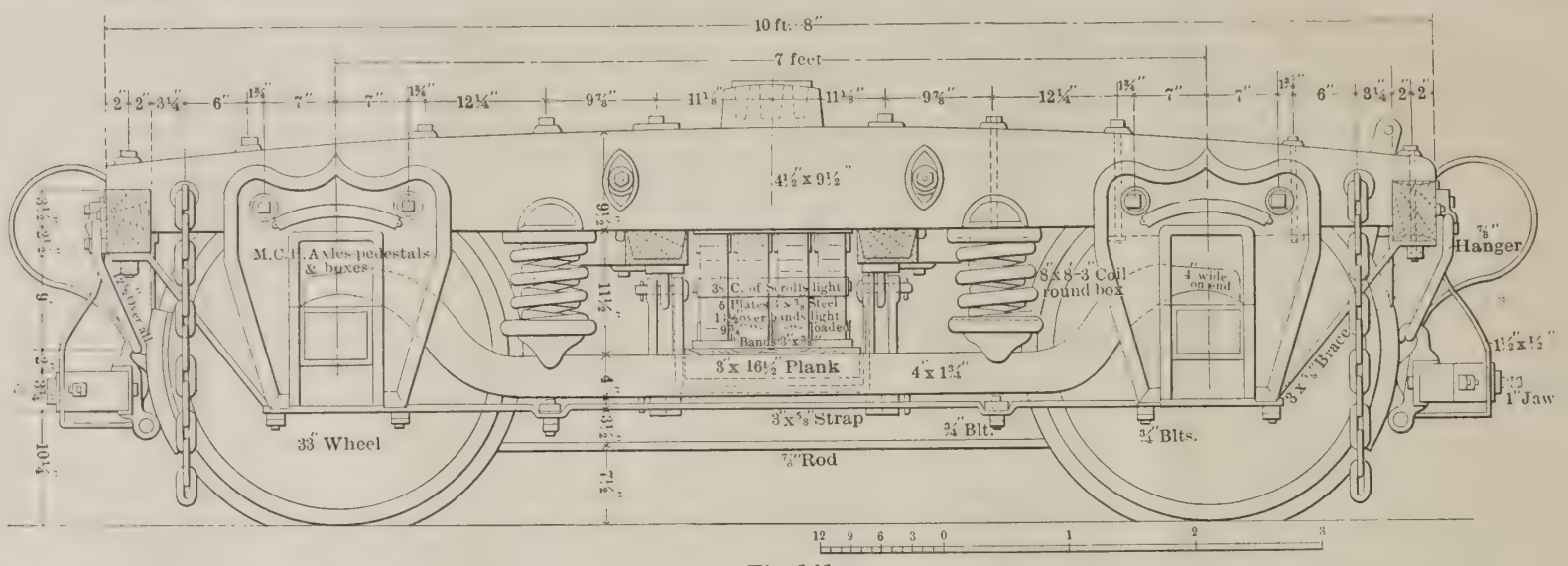


Fig. 141

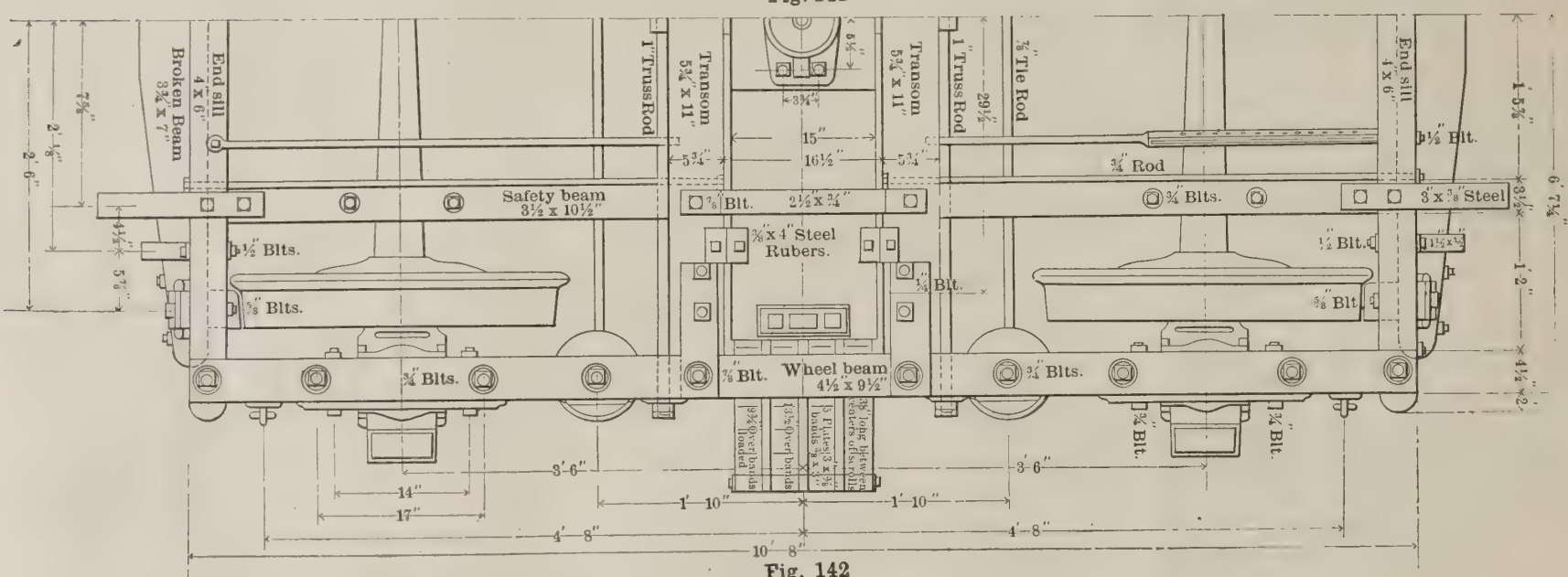


Fig. 142

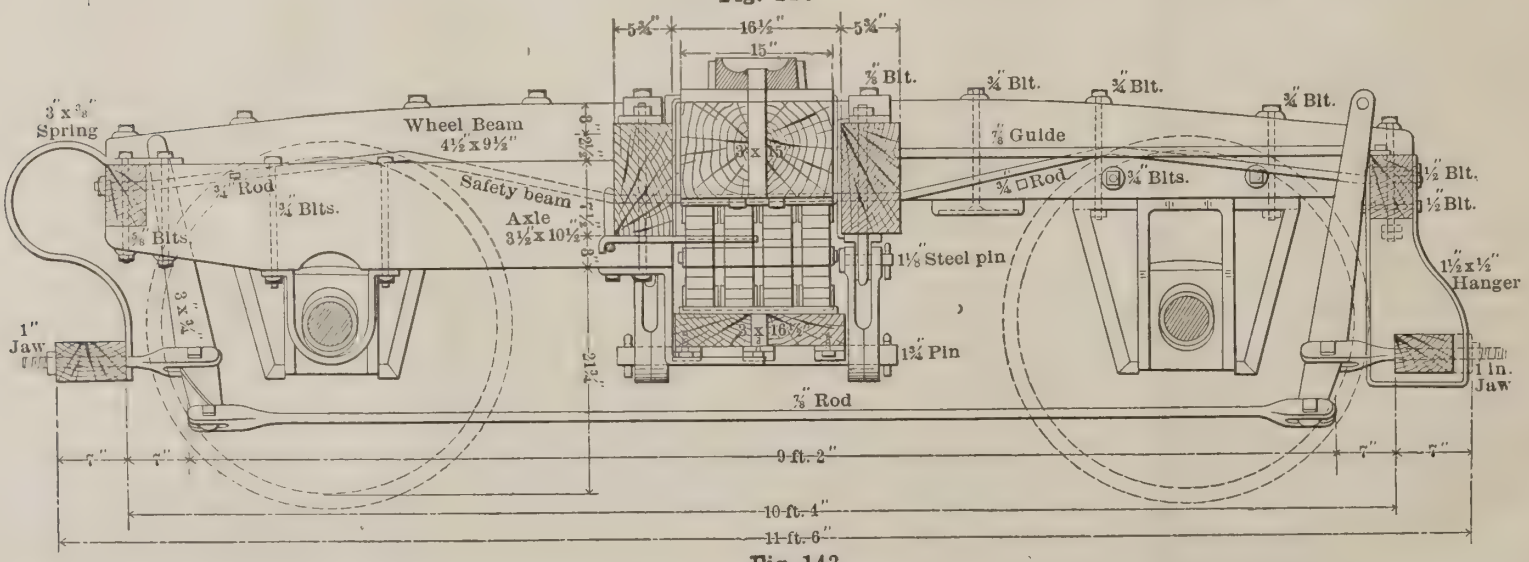


Fig. 143

the ends of the wheel pieces and are fastened to these by the above-mentioned truss rods and one ¾-inch vertical bolt which passes through the projecting part of the wheel beam and which also serves to fasten the end of the iron pedestal brace. The top edge of the end piece which comes nearest the end of the car frequently comes in contact with the drawbar, and is, therefore, in such cases reduced. Ordinarily a cutting out to a depth of 2 inches and for a distance of 30 inches will answer, but in some exceptional diately outside of the transoms. One bearing shaped from a ⅝ × 3-inch bar answers for both rods; it is attached to the lower edges of the transoms and also acts as a tie, as shown. Suitable beveled cast-iron washers are provided on the face of the wheel beam.

There are four axle safety beams connecting the transoms with the end pieces; they are of 3½ × 10½-inch oak reduced and framed, as shown in the detail drawing, Fig. 148, and are located 14 inches distant from the wheel pieces; box affected by it are shown among the other details of the cast-iron parts in Fig. 146.

It has perhaps been observed by every one concerned in the maintaining of passenger trucks that the journal bearings wear much more rapidly at the rear than they do at the front. This is probably due to the fact that the back end of the journal, being nearer the hub of the wheel, is more rigidly supported; it cannot be caused by the pedestal being out of plumb, as these as well as the flanges on

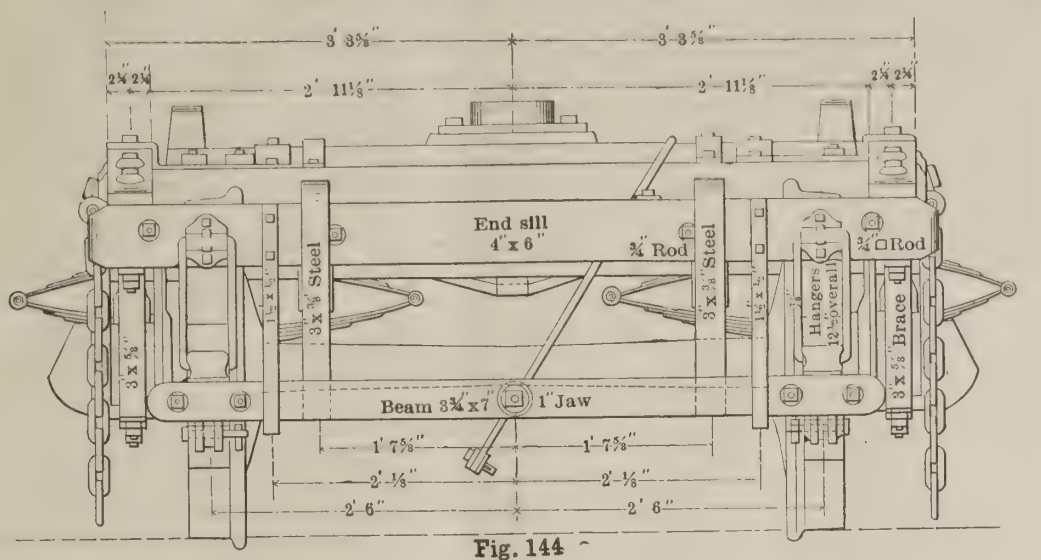


Fig. 144

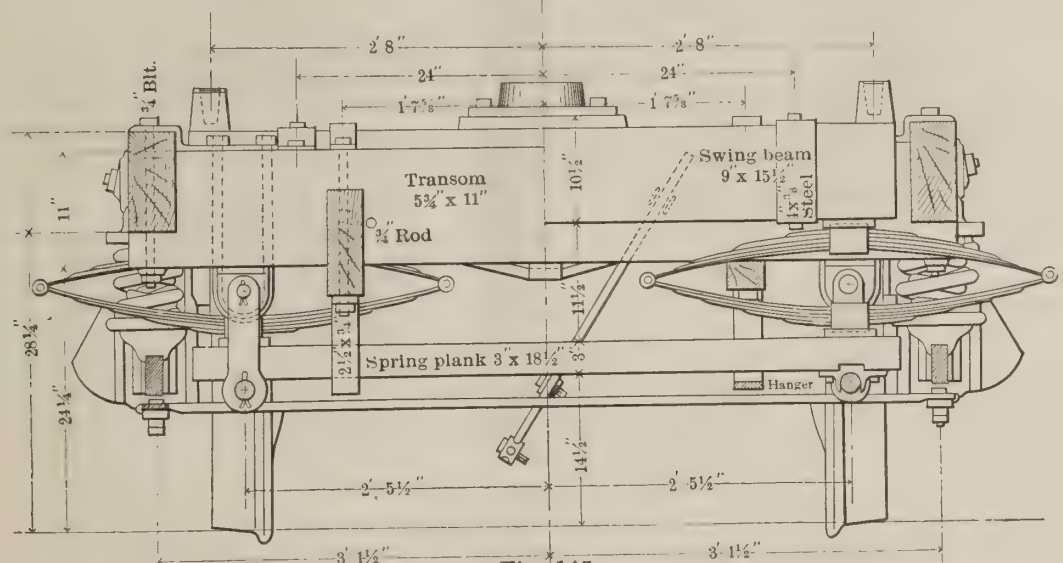


Fig. 145

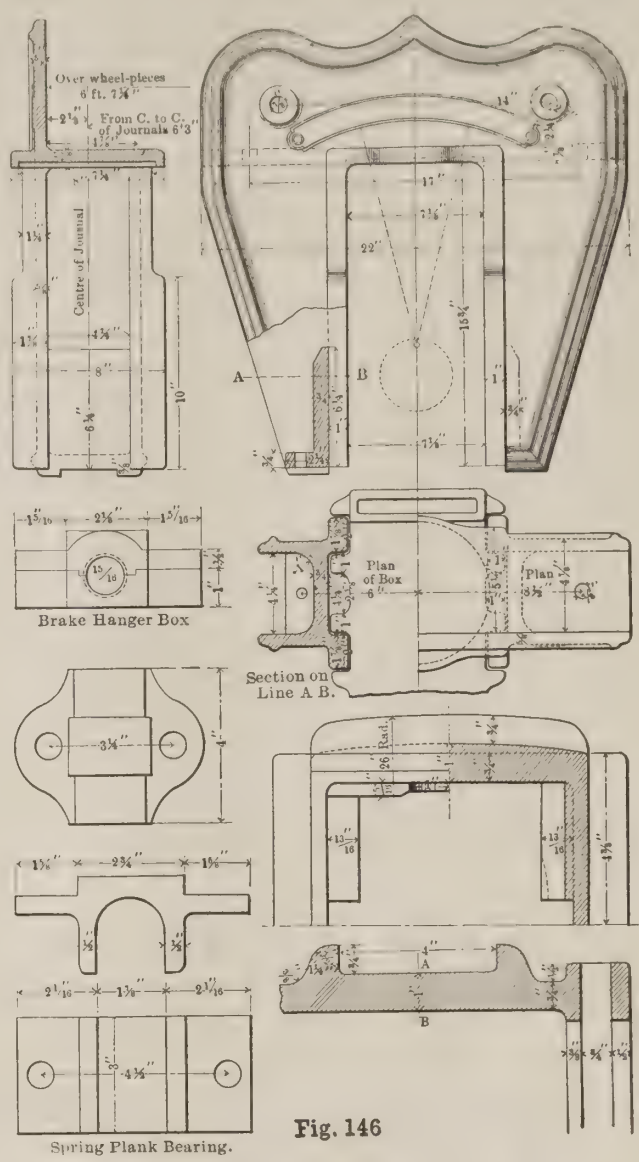
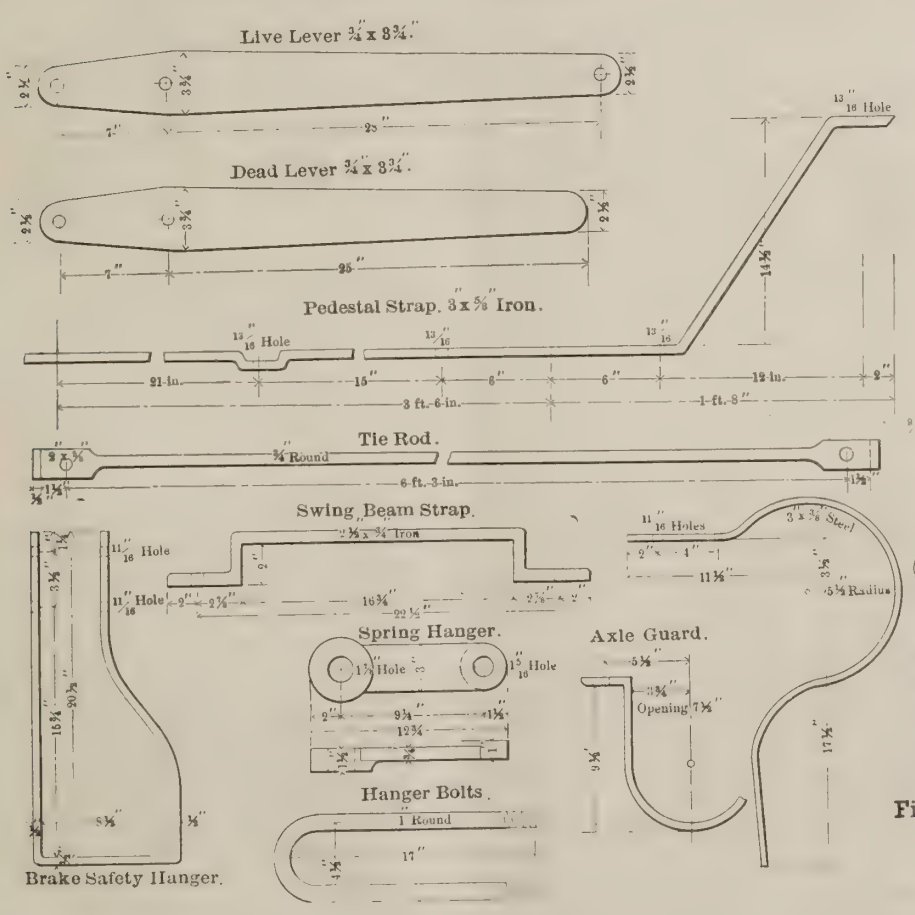

Over wheel-pieces 6 ft. 7¼"
From C. to C. of Journals 6'3"
Centre of Journal
Brake Hanger Box
Plan of Box
Section on Line A B.
Spring Plank Bearing.

Fig. 146



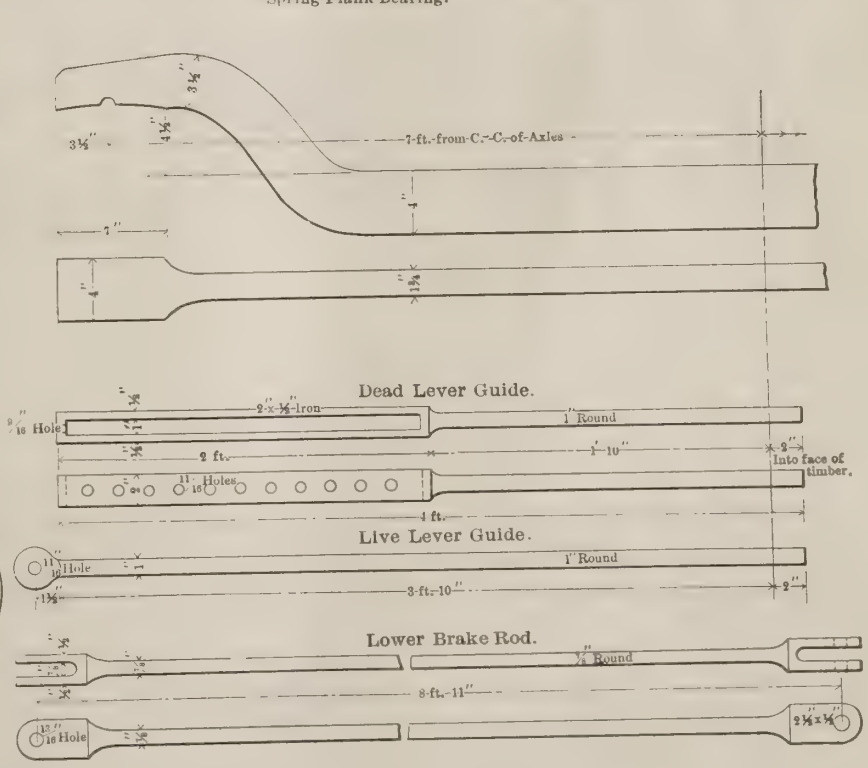


Fig. 147

and in all cases where 42-inch wheels are used, from 4 to 6 inches is required. Such end pieces must, of course, have a curved lower edge to correspond with the cut away upper edge, and as the resulting form is rather weak, owing to so much cross grain, the top edge, and usually the lower edge also, is faced with an iron plate for some distance from the ends.

The transoms, having a 5¾ × 11-inch cross-section and being placed at a distance of 16½ inches from each other, are framed in between the wheel pieces with mortises and tenons and with the portion which projects below the wheel pieces coming flush with the outside faces of them; a ¾-inch bolt is applied at this point to assist the tenons in carrying the load. The frame is tied at this point by two 1-inch rods which also serve as truss rods, being placed immea ¾-inch tie rod is placed at the side of each and extends through the transom and end piece.

The above constitutes the truck frame proper, but numerous attachments are needed to complete it. To commence again with the truck sides, the most prominent members are the pedestals; these are of cast iron and have large flanges by which they are attached to the timber, four ¾-inch bolts to each pedestal being used for this purpose; two of these are applied horizontally and two vertically. The working faces of the jaws and the corresponding projections on the sides of the boxes are so shaped that there is an ample wearing surface in both directions. These surfaces are not tooled: care should therefore be taken both with the patterns and in molding to secure an approximately close fit. The standard pedestal and the parts of the the boxes show perceptible wear in a corresponding direction, and even when they are known to be perfectly aligned this unequal wearing of the bearings and journals has been noticed. But whatever the cause may be, the only remedy, as has been demonstrated on at least one prominent road where this plan has been adopted, is to place more weight on the outer than on the back end of the journal by moving the equalizer from $\frac{3}{16}$ to ¼ of an inch off and outward from the center line of this. The advantages of the collarless journal were pointed out when describing freight equipment, and it is therefore necessary only to call attention to the fact that they are beginning to be appreciated, at least as far as passenger cars are concerned; collarless axles are now used under a large number of these, and are beginning to make their appearance under freight cars.

Connecting the jaws located on the same side of a truck and secured to them with ⅝-inch bolts is a ⅝ × 3-inch iron bar termed the pedestal tie-bar; in this case this is extended beyond and upward from the pedestals until it meets the end sills, to which it is fastened, as already stated; but in some instances when a brace is used at all, these portions of the bar are separate pieces of either flat or round iron. Connecting the pedestal tie-bar at one side of the truck with that at the other for the purpose of preventing the spreading of the pedestals at the bottom, a pair of ⅞-inch *pedestal stay rods*, located as far apart as the wheels will permit, are introduced; they have flat and gibbed ends and in this instance, because the room is limited, the tie-bar is offset to receive them, and for the same reason the bolts which fasten them have either very thin square or countersunk heads.

A suitably curved iron bar, the equalizer, rests on the top of the journal boxes; the body of this bar is 1¾ inches thick and 4 inches deep, which section gives a rather small safety factor, and the tendency therefore of late is toward a somewhat larger cross-section; the ends which are in contact with the boxes are widened to 4 inches to more certainly prevent lateral oscillations.

The frame rests on four spiral springs which are supported by the equalizers, two being placed on each and at a distance of 44 inches from each other, measuring from center to center. The equalizing springs of this particular truck have an outside diameter of 8 inches and are 8 inches high when light, but 10 inches for the latter dimension is more usual now; they are nest springs of three coils, all of which are round bar steel. The springs rest in cast-iron cups or seats which have flanges engaging with the equalizing bars, but are usually not otherwise fastened to them. Similar castings, called caps, are fastened to the under side of the wheel pieces by a single bolt or lag screw; these also have flanges either on one or both sides of the timber.

The arrangement of the bolster is about the same as in a swing motion freight truck, with the one exception that the swing hangers or links are almost invariably much shorter and the resistance to the lateral motion therefore much greater. The width of the swing beam and spring plank is governed by the dimensions of the burden springs, which are always of the elliptic variety, are from 36 to 40 inches long from center to center of the scrolls, and from 12 to 14 inches high over all, both measurements being taken when the spring is not loaded. The plates, usually five in number, are $\frac{7}{16}$ or ⅜ inch thick by 3 inches wide and the number of bundles constituting one spring vary from three to five, triplicates being suitable for six-wheeled and quadruples and quintuples for four-wheeled trucks. If springs with a lesser number of bundles than as above indicated are used they have either wider plates, a larger number of these, or both. The springs are kept in place by thin flanged castings which loosely fit the spring bands; these castings are all made off the same pattern, but are termed seats when below and caps when above the spring; they are secured to the spring plank and swing beam, respectively, with ordinary wood screws.

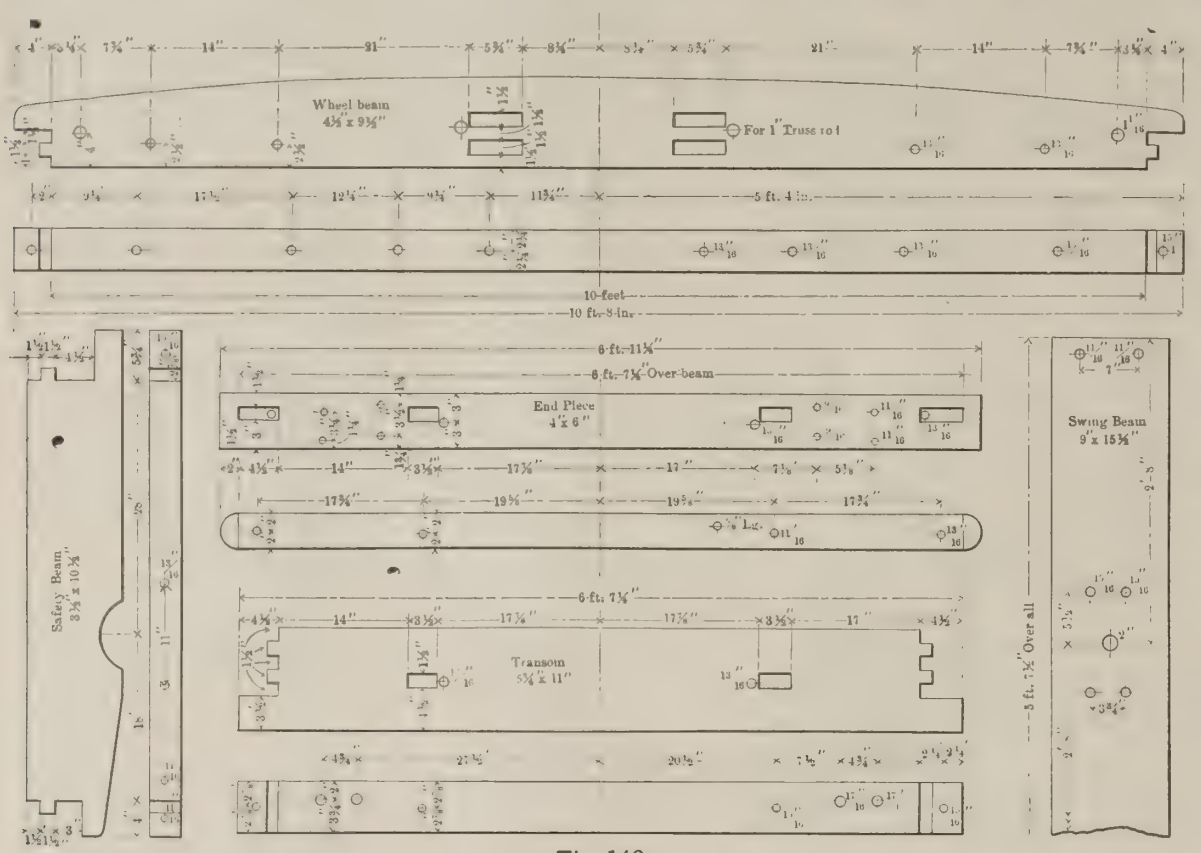


Fig. 148

In the example, which is arranged for four bundle springs having 3-inch plates, the swing beam is 15½ inches wide, its thickness is 9 inches and its length 5 feet 4 inches. To it are attached the lower or truck center plate and side bearings in the usual manner. Both swing beam and transom chafing plates are in this case of wrought steel, ⅜ × 4 inches in size, this material wearing nearly as well as cast-iron and being much less liable to fracture; the plates are formed and attached with ⅝-inch lag screws, as shown.

The spring plank is 3 inches thick and of the same width and length as the swing beam; it rests by means of suitable cast-iron bearings on 1¼-inch pins or axles, which in turn are supported by the swing hangers. These are attached with 1¼-inch steel pins to small cast-iron bearings which are secured to the under side of the transoms by 1-inch U-bolts, the nuts of which bear on ¼-inch plates placed across the junction of the transom with the wheel piece.

The style of swing hanger here shown is not used as much as the Y or fork shaped hanger, although being double it has in its favor that it is more safe. The round spring plank pin with cast-iron bearings is also somewhat out of date; the new bearing is a rectangular wrought-iron bar, having suitable journals forged on its ends, and is directly attached to the spring plank with two or more ⅝-inch bolts. Both hanger and bearing are shown in Fig. 149.

The hangers, and consequently the bolster springs also, are placed as far out from the center of the truck as practicable, so as to prevent the swaying of the car as much as possible; for the same reason the side bearings of passenger cars are also usually so adjusted that there is no space between them.

The spring plank safety hangers of ¼ × 2½-inch iron are shaped and attached as shown by ⅞-inch bolts, which are also used for the purpose of holding the transom tie straps, which are of the same size iron and of similar shape as the safety hangers and principally serve to check the rebound of the springs.

The brakes or, more correctly speaking, those portions of them which are attached to the truck, although properly not a part of this, are hung from the end pieces. The brake beams in both examples are of wood; metal beams are, however, more reliable and the different varieties of these are coming more into use every day; but where the use of wood is continued for this purpose the beams are generally strengthened with truss rods, a rigid beam being essential to the proper working of the improved air brakes.

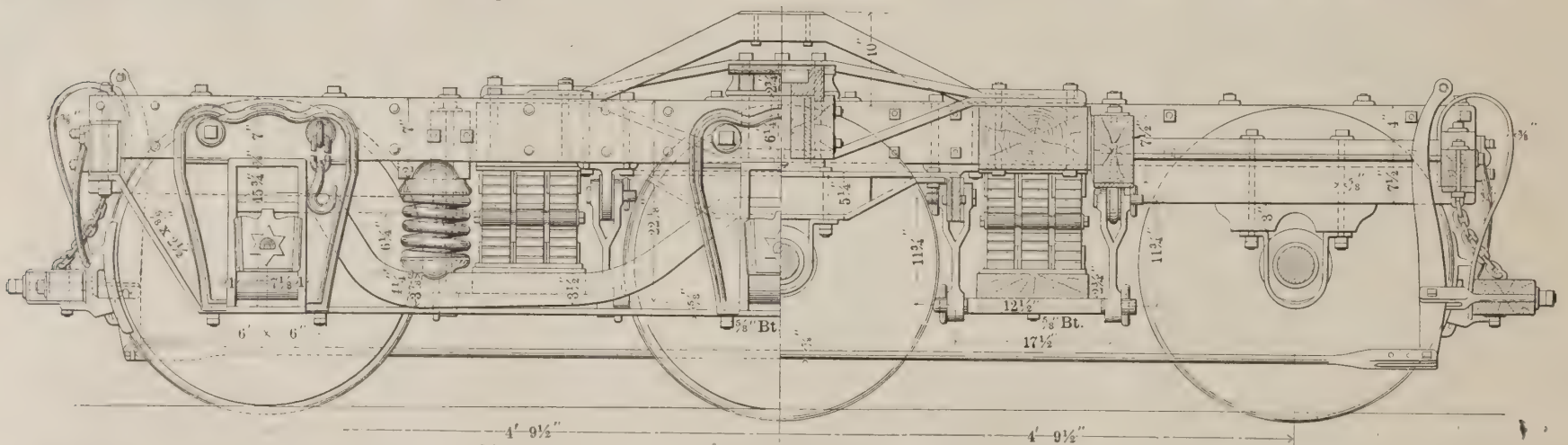


Fig. 149

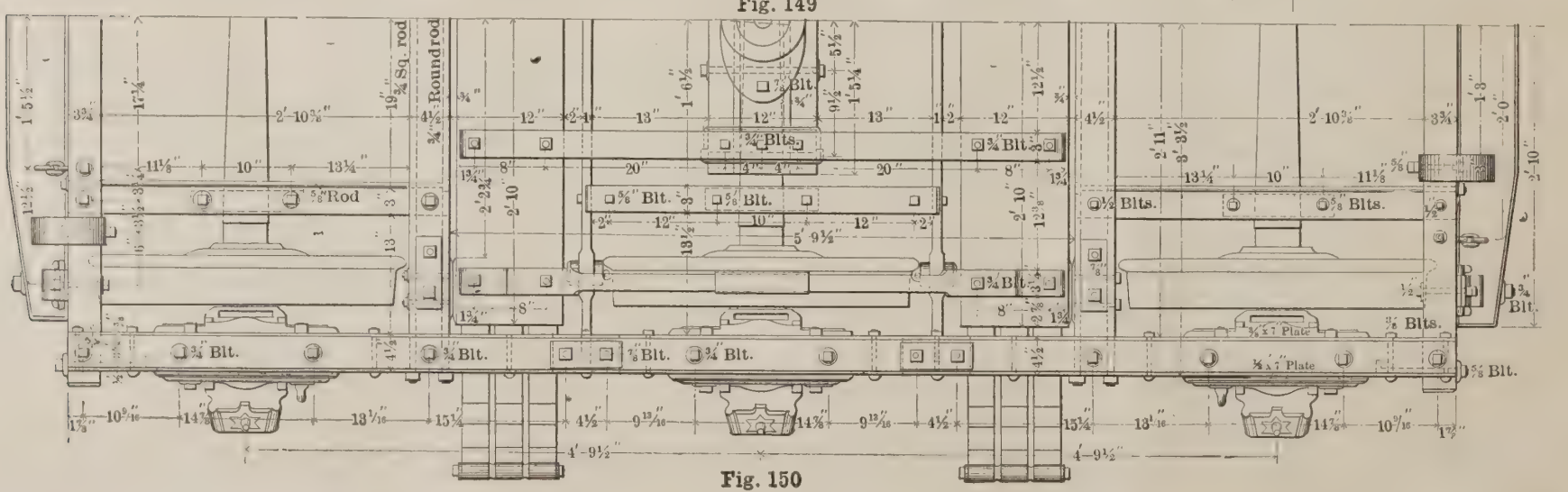


Fig. 150

To prevent the brake blocks from dragging on the wheels when not in use and also to take up the slack in the brake connections, what are termed brake release springs are provided; these are usually, as shown, of $\frac{3}{4} \times 3$-inch steel, fastened with two $\frac{5}{8}$-inch bolts each, one of which passes through the safety beam, and curved in such a manner as to bear against the inner edge of the brake beam. Some release springs terminate outside of the brake beam and are connected to this by a $\frac{5}{8}$-inch T-headed bolt, thus pulling the beam back instead of pushing it. This style has the advantage in that the tension of the springs can be adjusted by screwing on the bolts, and also in that they in some measure act as parallel hangers. Spiral springs are also used for the purpose in question; when in this form the spring is placed between the beam and a bracket-like extension of the axle safety strap, a rod or bolt passing from the beam through the center of the spring and a hole in the bracket. In some instances the brake beam safety hanger is of spring steel and its shape so altered that it bears against the beam and serves the purpose of a release spring.

The truck levers and rods are about the same as those used for freight cars when these are equipped with air brakes, excepting perhaps that, owing to the weight of passenger cars and consequently the braking force being greater, these parts are a trifle heavier. The lever guides extend from the end pieces to the transoms, the live lever guide being a simple 1-inch rod, which is driven into a close-fitting hole provided in the transom and is flattened at the other end to receive a $\frac{5}{8}$-inch lag screw. The dead lever guide is made by welding the ends of a fork-shaped $\frac{1}{2} \times 2$-inch bar to a 1-inch round bar; the upper end of the lever is confined in the opening so formed, and can be secured at any desired point by means of a pin and series of holes. This guide is attached like the other, excepting that a T-headed bolt is used instead of the lag screw.

A six-wheeled truck is composed of more parts, and is, therefore, much more complicated than the one just described; the length of the frame is also much greater, being nearly 13 feet in Fig. 149, which has 33-inch wheels and a wheel base of 9 feet 7 inches; when 42-inch wheels are used both wheel base and length over all are still greater. With the exception of length and that two iron transoms and two more safety beams are added, the frame does not differ in its construction nor in the sizes of its different members from that of a four-wheeled truck. There being two bolsters or swing beams, because the room at the center, where a single bolster requires to be located, is occupied by the third pair of wheels, the transoms are placed 5 feet 9½ inches apart. Fourteen and three-quarters inches distant from these are the middle transoms; these are of 1×5-inch iron and are so forged at the ends that they can be securely attached to the lower edge of the wheel pieces, two $\frac{7}{8}$-inch bolts at each end being used for the purpose. The safety beams for the center axle are in this case trusses formed of two $\frac{1}{2} \times 3$-inch bars, the enclosed space being filled with wood; the ends of the upper bar are turned at right angles, so it can be bolted to the iron transoms. The lower or compression bar is usually omitted and a beam of much the same shape and size as that used for the end axles is substituted.

The number of equalizing bars is four and the equalizing springs are so located that each journal carries its proper share of the load. The height and diameter of these springs are the same as those used for four-wheeled trucks, but their capacity must be greater as a greater load is placed on an equal number. The equalizers are somewhat lighter, because they are much shorter and carry each but one-eighth the load of the car against one-quarter in the other case.

There are, as has already been mentioned, two swing beams, and consequently two spring planks and a double set of burden springs and spring hangers. As the springs are composed of three bundles, the swing beams and planks are 12 inches wide, the other dimensions being practically not altered. The spring hangers attached to the middle transoms are like the others, but the pivot castings and U-bolts are omitted, as the connection is direct; the thickness of the transoms is increased at these points to 1⅛ inches, so as to have more wearing surface for the pins.

The two swing beams are connected by two sets of arch bars which carry the center-bearing beam to which the lower or truck center plate is attached. This beam being $7\frac{1}{4} \times 12$ inches and 2 feet 10½ inches long, is in this instance composed of three pieces of wood and two $\frac{3}{4} \times 6\frac{1}{4}$-inch iron plates, but usually is a single piece of wood. The arch bars of 1×3 iron are placed in notches provided on the top of the swing beams at a distance of 28 inches measuring from center to center, and are secured with two ¾-inch bolts at each support. To obtain a sufficiently deep truss the distance between the arch and inverted arch bar at the center is 9 inches, and as the center-bearing beam does not fill this space a cast iron bridge is introduced to make up the difference. The side bearings are forgings of much the same form as that of an equalizer, but are somewhat lighter, being 2×3 inches in the heaviest part, which is at the center; they are attached to the bolsters with ¾-inch bolts and at the usual distance from each other. The part of the side bearing coming in contact with the body side bearing is faced with a strip of $\frac{5}{8} \times 2\frac{3}{8}$-inch steel which is fastened with two ⅝-inch counter-sunk headed bolts, and can be renewed when worn out.

In a large number of six-wheeled trucks the side bearings are placed enough farther apart to bring them outside of the wheel beams and to make this possible the swing beams are lowered enough to allow their ends to project under and beyond the wheel beams. The equalizers must in such cases also be lowered, that is they must be more curved, to make room for the burden springs, and as that brings them in conflict with the pedestal tie bars these are offset so as to be out of the way. What particular advantage there is in this arrangemement is not clear; it is of course desirable to have the supports of the car body as far apart as possible, but the real supports are the burden springs and the location of these has not been and cannot very well be changed.

The brakes are ordinarily arranged the same as on a four-wheeled truck; that is, they are applied to the outside wheels only. This, of course, utilizes only two-thirds of the available braking capacity of the car, but the machinery required to apply brakes to the middle pair of wheels is so complicated that there is a disinclination to adopt this improvement. The arrangement of the rods and levers in Fig. 153 is perhaps as simple as it is possible to devise, although it has the fault that there are no dead levers for taking up the slack, the only provision for that purpose being a series of pin holes in the several connections. Turnbuckles would be preferable, as they can be located so as to be less difficult of access, and also because by the means of these the length of the rods can be adjusted to a nicety and without the aid of clamps which it would in this case be necessary to use if there were release springs on the brake beams, as there always should be.

There are two levers or equalizers located as shown, and attached to the two ends of a connection which, as it must be curved to clear the center axle, is rather heavy and double, because this form is cheaper and more convenient than a forging. The lower arm of the short lever is directly attached to the fulcrum of the middle brake beam and the upper arm of this lever and the lower arm of the long lever, through pull-rods to the outside beams. For the support of the end of the middle connection, which carries the long or main lever, a hanger attached to the center-bearing beam is provided.

Fig. 154 shows the additional levers and connections required on the body of the car, both to obtain the necessary leverage and to place the lever rods in the central position called for. The leverage required and consequently the travel of the piston in the cylinder would increase in direct proportion to the total pressure exerted, if the diameter of the piston were the same for all classes of cars. This might be provided for by varying the length of the cylinder, but it has been found more convenient to vary the diameter. As has already been mentioned, for freight equipment an 8-inch cylinder is used: this is increased to 10 inches for 8 wheel passenger cars and to 14 inches for the heavy drawing-room cars when brakes are applied to all of the wheels.

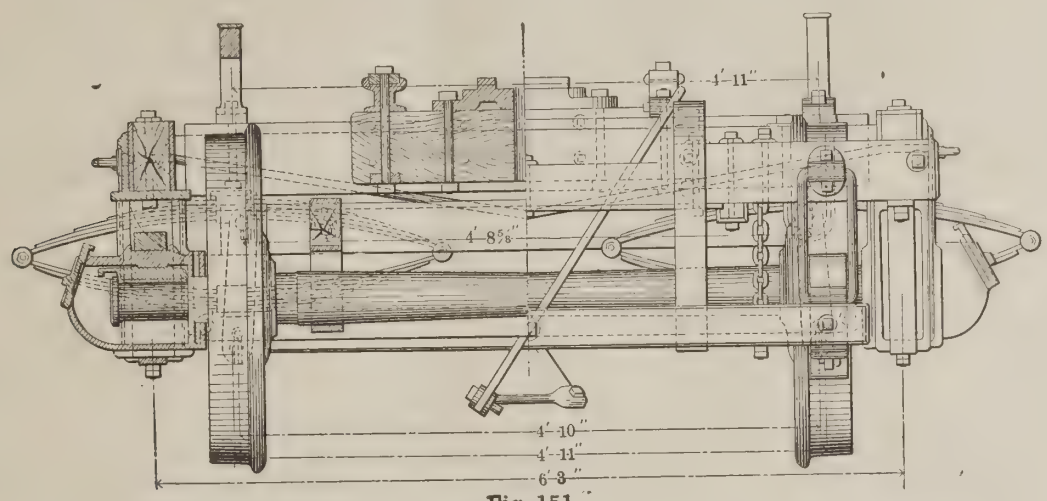


Fig. 151

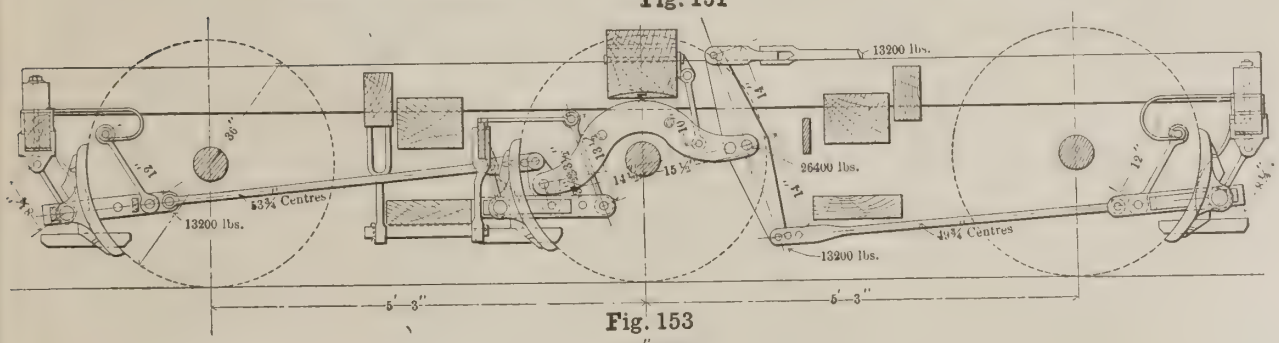


Fig. 153

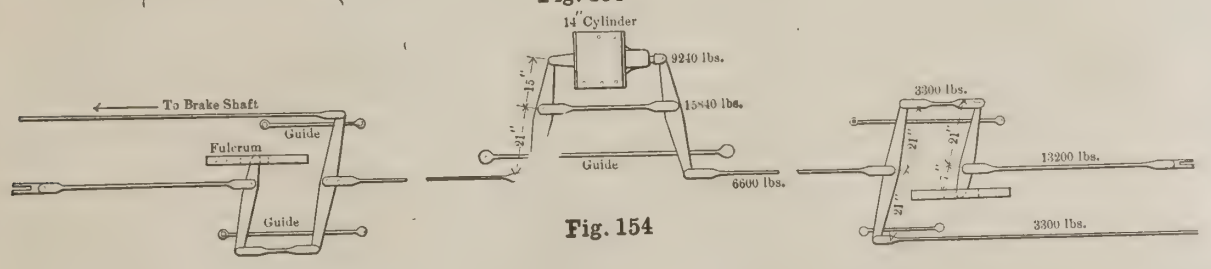


Fig. 154

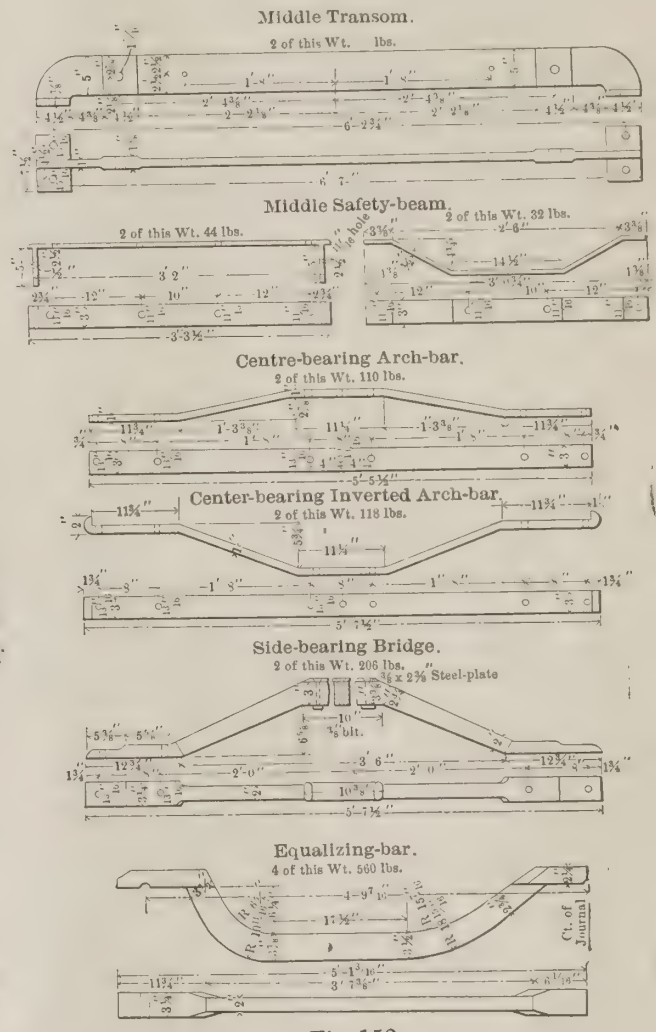


Fig. 152

The great steel bridge across the Columbia River at Vancouver will be a mammoth concern. It will be 6,000 feet from the Washington to the Oregon shore. It will be double-tracked, with a roadway on top for teams, and will be erected upon pneumatic piers. The pivoted pier, or draw pier, will support a draw which will give an opening of 200 feet on either side for vessels to pass, and the span immediately south of the draw span will be 375 feet. The whole structure is to be of steel, built 10 feet above the high water of 1876, and 40 feet above low water. On account of the sandy formation it will be necessary to go down 80 feet below low water to get a firm foundation. There it rests on a foundation of coarse gravel similar to that upon which the great bridges across the Missouri River are built. This gigantic structure will cost over $1,000,000 and employ hundreds of men in its erection. It will be January 1, 1892, before the cars can pass over it. The company is pushing its bridge and also its road as fast as men and money and its present perfected plans will permit. They have now between Vancouver and Kalama over 2,000 men and 1,500 teams at work.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

MORSE BUILDING.....NEW YORK.

ANGUS SINCLAIR, Editor.

DECEMBER, 1890.

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

To Subscribers.—*We occasionally receive complaints from subscribers that their paper is not received regularly. When cause for such a complaint exists, the blame lies with the mails or with the method of delivery, for the paper is mailed regularly to every subscriber each month without mistake. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

Information Wanted on Designs of Link Motion.

Committees have been appointed repeatedly during the last 10 years by the Railway Master Mechanics' Association to investigate the subject of valve motion for locomotives. Very interesting and to some extent valuable reports have been presented, but it appears to us that in every instance those who worked out the investigations devoted the greater part of their attention to questions that were not of the first importance. There is only one form of valve motion successfully used on reversing engines, and that is the link motion. There are a few radial gears and peculiar forms in use that find tolerance for special reasons, but they all distribute the steam substantially in the same way as motion operated by the shifting link. The invention of the link motion was, to a great extent, a lucky accident, but the valve gearing produced has proved a wonderful combination of mechanism, and one whose performance eventually compels admiration from those who are least disposed at first to see anything but defects in this method of operating valves. Hundreds of attempts have been made to design valve gearing that would displace the link, and many very promising inventions have been thoroughly tried, but the link in the end has maintained its ascendancy, for the simple reason that it distributed the steam as well as anything ever offered as a substitute, and was more durable and less liable to derangement than any other motion. It came into general use on its own merits alone, for there were behind it no artificial forces like patent interests to push it into favor, and it had to take the place of various gears that were supported by influential proprietory considerations. When the link motion began to be applied to locomotives, nearly fifty years ago, there were several forms of reverse gear that had become popular and were in favor with enginemen, the most conservative class of mechanical men in existence; yet, with all these active and passive elements of opposition to contend against, the link motion came steadily into use, and experience alone was necessary to extend its popularity. It also took possession of the marine field as thoroughly as it monopolized locomotives, and nothing has touched its supremacy as a valve gear for ocean steamers.

With all its good practical features, the link motion is a decidedly imperfect mechanism when examined geometrically alone. There are certain movements which a valve ought theoretically to receive at particular periods in distributing steam to the cylinders, which the action of the link motion does not keep correct time with. The theory is, that the ports should be opened to admit a sufficient volume of steam at the beginning of the stroke to maintain nearly steam chest pressure to the point of cut off. The steam ought to be cut off sharply and retained in the cylinder till the stroke is nearly completed, when a quick opening should be made to ensure an unobstructed passage to the steam in its way to the atmosphere. The valve ought then to remain open during the greater part of the return stroke, and closure should only take place in time to give sufficient compression to lead the crank quietly over the center. The action of the link motion moves the valve in a manner that deviates considerably from these theoretical requirements. The link motion cannot be adjusted to make the valve cut off at the same points in both gears. When the link is drawn up to cause an early cut off, it also causes an early release, and early closure for compression, with the result that in some cases the capacity of the cylinder is seriously reduced. Notching up the links also causes increase of lead opening, so that with some engines the piston meets with obstruction from the steam before the end of the stroke is reached. These are the abstract defects of the motion.

The men who have had the responsibility for the building and operating of locomotives have never been strongly influenced by mere theoretical considerations, and as they found that locomotives equipped with the link motion hauled trains with as little fuel as that used by engines having other valve motions, and that the mechanism could be kept running without repairs longer than any other valve gear, they kept right along applying it to their motive power. The man, however, whose business it was to discourse on mechanism analyzed the link motion, and to him its faults and shortcomings stood out very conspicuously. He had no opportunity for finding out that some of the link motions' worst faults, as seen on the drawing board, were its most valuable features in practice, so he got in the habit of denouncing the link motion. If he ever was brought into intimate connection with the operating of locomotives he would become converted to the superiority of the link motion and his voice would no more be heard in opposition. But there were others coming up who had to go through the same experience. Those whose voices and pens are most active in teaching the principles and practice of engineering have generally only got the length of finding out the defects of the link motion, and so that theme has been harped upon with vigorous and protracted assiduity. Wonderful to relate, the link motion kept on working successfully, and all sorts of steam engine designers persisted in using it, in spite of the persistent attempts to discredit its usefulness. But the friends of the link were kept constantly on the defensive, and that was probably the reason why those who were appointed to investigate the subject of valve motion for locomotives always felt called upon to make out a defense of the link motion. The reports have shown very conclusively that all substitutes for the link motion have proved expensive appliances for those who tried them, and to some extent the causes of failure have been shown up. But little has been said about the designing of the link motion itself.

We consider that a very useful report might be prepared on the best forms, dimensions and proportions of the various parts of the link motion. There are certainly good and bad link motions in use, and it would be of direct service for many railroad men to read an exhaustive report on the causes that produce the difference which is apparent to every man familiar with the working of locomotives. Great improvement has been effected in the designing of link motion since draughtsmen abandoned the antique model, for laying down the lines and points on the drawing board, but there is still much ignorance to be dispelled about the scheming of link motion. We know of roads where till lately one form of link was used for all locomotives. Engines with long eccentric rods and short eccentric rods, those having valves with long lap and valves with short lap were all supposed to work equally well with a link of uniform length and radius and the hanger pin set in the same place. On another road we have seen the resources of a machine shop exhausted in trying to square the valves of an engine whose frames had been lengthened and the driving wheels spread six inches and no change made in the valve gear beyond lengthening the eccentric rods. It was considered to be remarkably strange that the cut-off should be so hard to equalize. This did not happen in a remote period of railroad history either. There is a great deal of uncertainty, where there ought to be exact knowledge, as to the effect of long and short link radius, about the location of the point of suspension, and about other really important questions connected with valve motion mechanism. The committee which will present plain and conclusive information on these matters will earn the gratitude of numerous railroad men.

Ignorance of Train Mechanism.

A correspondent in another column, who is a mechanical officer of a Western railroad with the best of facilities for watching the habits of trainmen, gives a graphic and humorous account of the tumult raised by a couple of switchmen in their efforts to couple, with the knuckles closed, two cars equipped with the M. C. B. type of coupler. Other instances are also given illustrating the ignorance of trainmen concerning the parts of train mechanism that they ought to be perfectly familiar with. It is a melancholy fact that on many roads the trainmen appear to take no more interest in acquiring knowledge how brakes and signals and heaters work than if they had nothing whatever to do with such appliances. The men who display this kind of apathy about their business are an inferior sort of beings whose natural lot is performing labor that calls for no exercise of thought or reason. But they are really not so much to blame as the superintendents and train masters, whose duty it is to see that the train hands perform their duty properly. For years past the motive power officers have been stimulated to compel enginemen to acquire knowledge of various kinds relating to their business, and the practice has been generally introduced to subject men to serve a sort of examination before they are passed for promotion. The result is that railroad companies are receiving much better service from enginemen than they formerly obtained. The men do not consider it any hardship to be required to study details relating to their work, and they are made better men in every respect by the habits that grow from the mental training made compulsory.

There is no reason why all other men connected with train operating should not be required to understand as much about car mechanism as enginemen are expected to know about the locomotive. The men are drawn from the same class and their previous mechanical training is about equal. When trainmen are directed to open and close valves at certain times to keep heaters in operation, the complaint is often heard that it needs an engineer to run a modern car heating plant. A superintendent looks over the arrangement of pipes and valves without trying to comprehend how the thing operates, and agrees that the men are hard used when they are required to attend to such things. Superintendents of this stripe are themselves incompetent, and their ill disguised sympathy keeps the men from learning what could be acquired with very little effort were it gone about in the proper spirit. The tendency of the time is to increase the mechanism used in the moving of trains. By this complexity of parts, certainty and simplicity of operation are generally secured. Those who are not willing to learn all about every new car attachment necessary for modern practice should confess that the business has grown beyond their capacity and retire from the field. This duty is particularly urgent in the case of those who are in charge of men and are responsible for perpetuating ignorance.

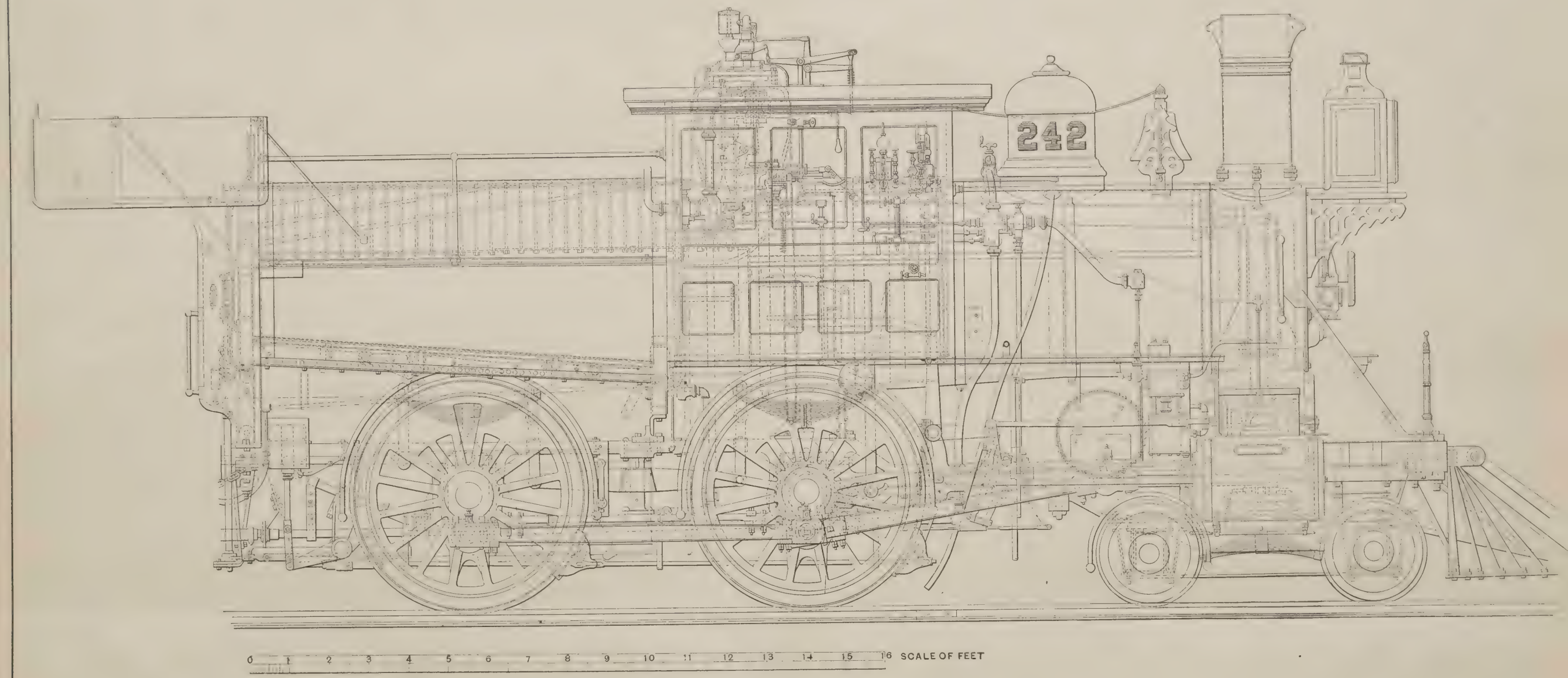
Report on the Old Colony Disaster.

The Massachusetts Board of Railroad Commissioners have published an account of a very exhaustive investigation into the terrible train accident on the Old Colony Railroad on August 19, whereby 23 persons were killed. It will be remembered that the accident was caused by the section man leaving a jack on the track which derailed the engine of a passenger train. The engine ran over the ties for some distance and then fell over on its side. One of the passenger cars, torn from its trucks, was forced over the locomotive, and a driving wheel of the latter tore through the car floor grinding seats and passengers into a mass of kindling wood and mutilated corpses. When the accident happened, the train was said to be running 25 miles an hour, yet the car that plowed itself on the locomotive ran 640 feet after the brakes were applied. The conclusion arrived at is that the train was deficient in braking power. In the famous tests with the Westinghouse 50-car train, at a speed of 33 miles an hour, a stop was made in 272 feet.

The Railroad Commissioners' report says that although the engine was equipped with a driver brake, it was operated by a separate handle from that applying the train brake, and that the engineer failed to apply it at the time of the accident. Of the nine cars which composed the train, only three were equipped with the quick-action triple valve. The conclusion come to is, that had all the cars been equipped with the quick-action triple valve and the brake on the locomotive worked by the same handle that applied the train brake, no loss of life would have happened.

The Old Colony Railroad Company were peculiarly unfortunate in meeting with this accident, for their trains are better equipped with stopping power than most railroads in New England. Out of 138 passenger engines 53 have driver brakes, 29 of which are operated in connection with the train brake. This contrasts very strongly with the Boston & Maine which have 244 passenger locomotives only three of which have driver brakes, and the Fitchburg which has 93 engines, six of them having driver brakes, none of which act in unison with the train brakes.

The Old Colony accident furnishes another strong argument in favor of applying brakes to every wheel behind the engine truck, and for having them all operated in unison. When driver brakes are used for emergencies alone, they are generally neglected at the moment when they are most urgently needed. The report of the Railroad Commissioners of Massachusetts on the Old Colony accident emphasizes very strongly the necessity for employing driver brakes as part of the stopping power of every train. The time is rapidly approaching when the railroad officer who fails to use driver brakes will in case of accident be accused of criminal negligence, as readily as the man who now attempts to run a fast passenger train with hand brakes as the only stopping medium. If an accident like what happened on the Old Colony were to overtake next week a company which does not use the best known methods for stopping trains, it would be a hard matter for the responsible officers to escape a criminal prosecution. There are still comparatively few railroad companies that put in the hands of the engineer the most perfected means of stopping the train promptly.



GRAHAM'S CULM-BURNING PASSENGER LOCOMOTIVE

For Delaware, Lackawanna & Western Railroad.

Best Forms of Locomotive Side Rods.

The progress that American master mechanics have made during the last few years in moving away from expensive prejudices was very well illustrated in the discussion on locomotive side rods that took place at the last meeting of the Northwestern Railroad Club, where all the speakers favored the use of solid-end side rods. Only a few years ago it was the greatest rarity to find a motive power man, of high or low degree, who did not swear by the strap ends with keys, set screws, and divided brasses. Some 10 years ago the late Howard Fry began advocating the use of side rods with solid ends; but for a time he had very few followers, and the sentiment of nearly the whole railroad world was against him. Curiously enough the strong argument used against solid-end rods was the difficulty of doing running repairs and of making adjustments. To take out a bush and put in a new one, when lost motion had to be taken up, seemed a useless waste of material and the throwing away of labor. To adjust rods to the proper length without the use of keys, seemed an impossibility and an invitation to disaster from broken crank pins or side rods. Practice, however, soon demonstrated that the mechanical theory which led to the advocacy of solid-end rods was correct. Experience proved that a bush could be thrown into the brass scrap heap and a new one put in, when lost motion had to be taken up, without increasing the expense of round house repairs, and that the unvarying length of rod was much safer than the rod that could be manipulated with keys. In addition to this, the first cost of the solid end was much less than that of the strap arrangement, and it contained less weight of unbalanced revolving material. Some master mechanics, who control the designing of locomotives, still cling to the strap end for side rods; but these men are becoming monthly diminished in number, and the railroad companies do not suffer from the change.

At the Northwestern Railroad Club meeting the form of section favored for side rods was what is known as the "fishback." A point made in favor of this form of rod was that it had lateral flexibility. We very much doubt the advantage of this property. We have known of several cases where flexible side rods had to be abandoned because the movement ultimately resulted in breakage. Objections were urged against the I-section of rod on account of its being expensive to make. The testimony that comes to us from those using the I-section side rod is to the effect that it is the safest that has ever been tried. Scientific calculations and tests have demonstrated that in this shape of rod the material is put in its strongest form. The rod combines strength with lightness, two very important characteristics in a side rod. He is a very short-sighted designer of locomotives who will specify an inferior form of side rod on account of a superior form costing a little more money in the first instance.

Electrical Transfer Tables.

Every head of a railroad rolling stock department who has had the opportunity of watching the operation of electrically worked transfer tables, readily admits that electricity is the proper power for doing that work, and that it is the cheapest connection with shops where electricity is used for lighting. Yet we frequently find that steam and other means of transmitting power to operate transfer tables are still frequently specified where new shops are designed or important changes made in old ones. The electric motors are rejected on the score of high first cost. If those who bring about this decision would figure closely on the cost of other methods of operating transfer tables, we think that the choice would oftener be for electricity. The prevailing practice of calling out workmen to do the pushing every time a transfer table has to be moved is the most expensive way of providing power that we are acquainted with. The men who conclude that their companies cannot afford to introduce improved methods of operating their transfer tables are the men who are contented with all kinds of ancient tools, and persuade themselves that they are valuable officers because they never displace any article as long as it can be used.

Scarcity of Freight Cars.

The number of new cars built during the last two years has been simply enormous, yet we do not remember ever having heard so many complaints about scarcity of cars as have been uttered since the movement of the Western crops began. The application of power brakes to freight cars has provided the means that enabled many roads to move freight trains with safety much faster than formerly, and the National Car Service officers have succeeded in greatly reducing the detention of cars at unloading points, but, with all that, cars have been very scarce. In one division of a Western road they were lately said to have freight waiting sufficient to load 5,000 cars at places where none could be furnished for a month. The motive power departments of railroads have made decided progress lately in providing means to move trains rapidly, and car associations have done much to expedite unloading and to prevent the use of cars as warehouses; yet the average daily mileage made by freight cars continues to be remarkably small. Railroad managers have been very vigilant in stimulating the mechanical departments to do their duty toward increasing the daily mileage of freight cars; but they are surprisingly lenient in dealing with delays for which the transportation departments are responsible. When loaded cars are delayed for repairs, or when locomotives fail in making running time, censures and threatenings make the atmosphere of the line lurid; but trains with their engines and crews stand mysteriously on side tracks for hours, and battalions of loaded cars crowd sidings at all leading stations, and no question appears to be raised as to who is responsible for the delays. On some railroads freight cars make a good mileage and are kept moving. By this means they earn a good income for the owners. On other roads, again, the average mileage is so low that increasing the number of cars is increasing plant that fills up the side tracks without augmenting the income of the company. Mismanagement has a great deal to do with the prevailing scarcity of cars.

The jerky, splashing pump for drawing water to wash with is rapidly becoming a curiosity in sleeping cars. When a sleeping car is taken in for repairs the arrangement for forcing out water by compressed air is applied before the car leaves the shop. An improvement that is of questionable utility has been introduced into many recent sleeping cars. Instead of the deep conical wash-basin, a shallow, oblong nickel-plated dish is provided, which at first appears a move in the right direction. But when a traveler half fills the basin and the train happens to give a lurch, the water dashes all over the place. It would be difficult to suggest new conveniences for the modern sleeping car. Ingenuity appears to have been exhausted in devising new luxuries for the comfort and convenience of travelers. The bath tubs, the peripatetic barbers, the ladies' maids, the portable libraries, the vestibuled platforms, the dining cars, and the buffets where there are no dining cars, now render first-clsss travel so complete in comforts that one marvels how any further improvements can be devised.

Personal.

Mr. A. Ritter, master mechanic of the Illinois Central at Chicago, has resigned to go into other business.

Mr. Abraham S. Hull, for 34 years master mechanic of the Cumberland Valley Railroad, died recently at Chambersburg, Pa.

Mr. E. H. Goodman, general manager of the Union Switch and Signal Company, has been elected vice-president of that company.

Mr. A. W. Dickinson, general superintendent of the Missouri Pacific Railway, with headquarters at St. Louis, has returned to duty after a long and severe illness.

Mr. John Atkinson, one of the oldest and most skillful car painters in the country, and for many years employed in the Michigan Central shops at Detroit, died last month at the age of 85.

Mr. Sidney Dillon, New York, has been elected president of the Union Pacific in place of Mr. Adams, resigned. Mr. Dillon was previously president of this road and was succeeded by Mr. Adams.

Mr. Charles B. Street, master mechanic of the Panhandle road, died at his home at Denniston, O., last Saturday. He was a brother-in-law of Superintendent Pitcairn, of the Pennsylvania Railroad.

Mr. Jonathan R. Herrick died at Albany, N. Y., last month. He was first superintendent of the Albany & Susquehanna Railroad, and continued his connection with the road as its city director until his death.

Mr. Frank E. Merrill, who gained considerable reputation as general superintendent of the St. Louis & San Francisco, has resigned to accept a position as superintendent of the Chicago & Erie division of the Erie.

Mr. A. V. H. Carpenter, the celebrated general passenger agent of the Chicago, Milwaukee & St. Paul, is about to retire on account of physical infirmity. Mr. Carpenter is in his 69th year, and has been in railroad service over 40 years.

Nathaniel C. Scoville, of New York, died suddenly last month. He was for many years in the firm of J. & N. C. Scoville, engaged in the manufacture of car wheels in Buffalo. For the last few years he had not been engaged in active business.

Mr. A. A. Jackson has resigned the office of general superintendent of the New York & New England Railroad. The office is now abolished, and in its stead the office of superintendent of transportation is established and given to R. E. Eavenson.

Mr. Charles H. Jackson, for some time vice-president of the Union Switch and Signal Company, has resigned, with a view of devoting his time exclusively to the United States Electric Light and Power Company, New York, of which he is general manager.

Major Sherman Conant, superintendent of the Florida Southern Railroad, died at Palatka on Friday night of pneumonia, after a week's illness. He was one of the most prominent railroad men in Florida, and had been widely known for nearly thirty years.

Messrs. R. C. Blackall, David Clark and G. W. Stevens have been appointed by President Mackenzie, of the Railway Master Mechanics' Association, to act in combination with a committee appointed by the Master Car-Builders' Association on Air Brake Inspection.

Mr. M. N. Cary, one of the ablest locomotive engineers in the West, has been appointed traveling engineer of the New York Central. Mr. Cary was the original of the "first-class fireman," whose operations are described in "Sinclair's Locomotive Engine-Running."

Mr. William Buchanan, superintendent of motive power of the New York Central, has gone to Europe to enjoy a much needed rest. His health has been failing slightly under the strain of constant attention to arduous duties, and his physician gave an imperative order to stop work for a season.

Mr. George Bernard, Purchasing Agent of the Mexican National Railroad, died last month. Mr. Bernard was born in Philadelphia in 1855. He entered the office of the Mexican National Railroad here as clerk a number of years ago, and since 1887 has been its Purchasing Agent and Assistant Treasurer.

Mr. F. Reardon, who has been appointed superintendent of the Missouri Pacific, is a graduate of the Union Pacific. He was round-house foreman, and then master mechanic, and was noted as an energetic pusher in getting engines out promptly under circumstances that often called for the overcoming of many difficulties.

Mr. A. G. Leonard, who has been assistant to Mr. William Buchanan, superintendent of motive power of the New York Central for several years, is performing the duties of his chief during Mr. Buchanan's absence. Mr. Leonard received a remarkably good training under Mr. Buchanan, and has proved a very apt pupil.

Mr. Charles F. Adams, for some years president of the Union Pacific, has resigned. Mr. Adams was elected to the position of president of the Union Pacific for the purpose of changing unsatisfactory methods that previously were said to prevail. He was not a railroad man and his management was by no means a brilliant success.

Those who have been over the Chicago & West Michigan lately speak very favorably of the improved condition of the rolling stock of the road under the able management of Mr. W. S. Morris, superintendent of motive power. Mr. Morris is a pupil of Mr. Jacob Johann's, and is a good representative of our modern progressive master mechanic.

John H. Van Vechton, of Port Jervis, N. Y., died at the New York Hospital on the 5th inst., aged 68 years, from the effects of a surgical operation. For eleven years he was master mechanic of the New York, Pennsylvania & Ohio Railroad Company's shops at Meadville, Pa., and for seventeen years master mechanic of the Erie Railroad Company's shops at Port Jervis.

Mr. A. W. Soper, president of the Safety Car Heating and Lighting Company, New York, has just returned from an extended tour made in the interests of his company. He reports business to be highly encouraging. The movement toward lighting railroad cars by the Pintsch gas system is advancing very rapidly, several important lines having lately arranged to provide the gas making plant. Mr. Soper, who was for three years general manager of the St. Louis & Iron Mountain Railroad, was held in high esteem as a railroad man, and he is no less popular as head of a railroad supply company.

Mr. W. H. Baldwin, who was lately appointed assistant to the vice-president of the Union Pacific, is a man who will do a great deal of good on that large railroad system, if he is permitted to work out his ideas. A ruinous evil about the Union Pacific has long been that the railroad officers were more inclined to work out personal animosities than to devote their energies to the interests of the company. Mr. Baldwin has been working to establish harmonious relations not only between the various officers themselves, but between the whole personnel of the company. His labors appeared to be productive of the very best results.

Mr. John Mulligan, the Superintendent of the Connecticut River road, has been elected President to succeed the late N. A. Leonard. During the 48 years that he has spent in railroad service, Mr. Mulligan has become one of the best known and most popular officers in New England, and he is well known outside that territory. He has served on but two roads. He was on the Western (Boston & Albany) between 1842 and 1852 as machinist and locomotive engineer, and on the Connecticut River road since 1850 as Master Mechanic for 16 years, and as Superintendent for the last 23 years. Mr. Mulligan is still an active member of the Railway Master Mechanics' Association, and takes a keen interest in the success of the organization.

For forty years Mrs. Mary Carroll has been the switch-women at the Central Railroad Junction in Macon, Ga., where several different railroad tracks meet. During this time she has always been faithful and efficient. She has never been the cause of an accident. Her duties have been responsible, but the road has never incurred a dollar of breakage, a moment of delay or the injury of a person on her account. She is perhaps the oldest and only switch-woman in the United States. There are hundreds of people who will recall seeing her in the little switch house at the junction, one mile from town. After so excellent a record, and so many years of capital service in sunshine and storm, in cold and heat, the Central road has placed her in a less irksome position. She has been made gate-keeper at the shops of the road.

Mr. William Westlake, of the well-known firm, Adams & Westlake, started life as a printer's devil in Milwaukee, from which he drifted into railroading. He rose to be a locomotive engineer of a passenger train and started one night from a station by mistaking the swinging of another lantern for that of the conductor. An old lady happened to be boarding the car at the time and she was thrown down and lost her leg. This set Mr. Westlake to inventing, and after long labor he produced the green and white globe now used in conductors' lanterns all over this continent. After that he continued his inventive labors and his patents are now counted by the hundreds. He invented the headlight, the car lamps, the oil stove and dozens of other things for every-day use. He has recently made some great improvements in the headlight. He says that he has found that it is the little things that pay, and that there is no money inventing costly machinery.

Mr. W. A. Scott, general superintendent of the Chicago, St. Paul, Minneapolis & Omaha, has been in Europe for six weeks investigating the subject of compound locomotives. Mr. Scott was supplied with the very best facilities for judging of the performance of the various types of locomotives working in the principal railways where they have been introduced. We enjoyed a very pleasant visit with him on his return to New York, and we very much regret to say that all he would say about compounds was strictly confidential. He visited Colonel Martin and obtained all the facts available about the operation of the Rhode Island compound on the Brooklyn Elevated, and he also stopped off at Schenectady to ascertain what they are doing in relation to compound locomotives.

Mr. Scott has lately suffered a sad family bereavement which seriously affected his health. He still looks ill, but assures us that the journey to Europe has done him much good.

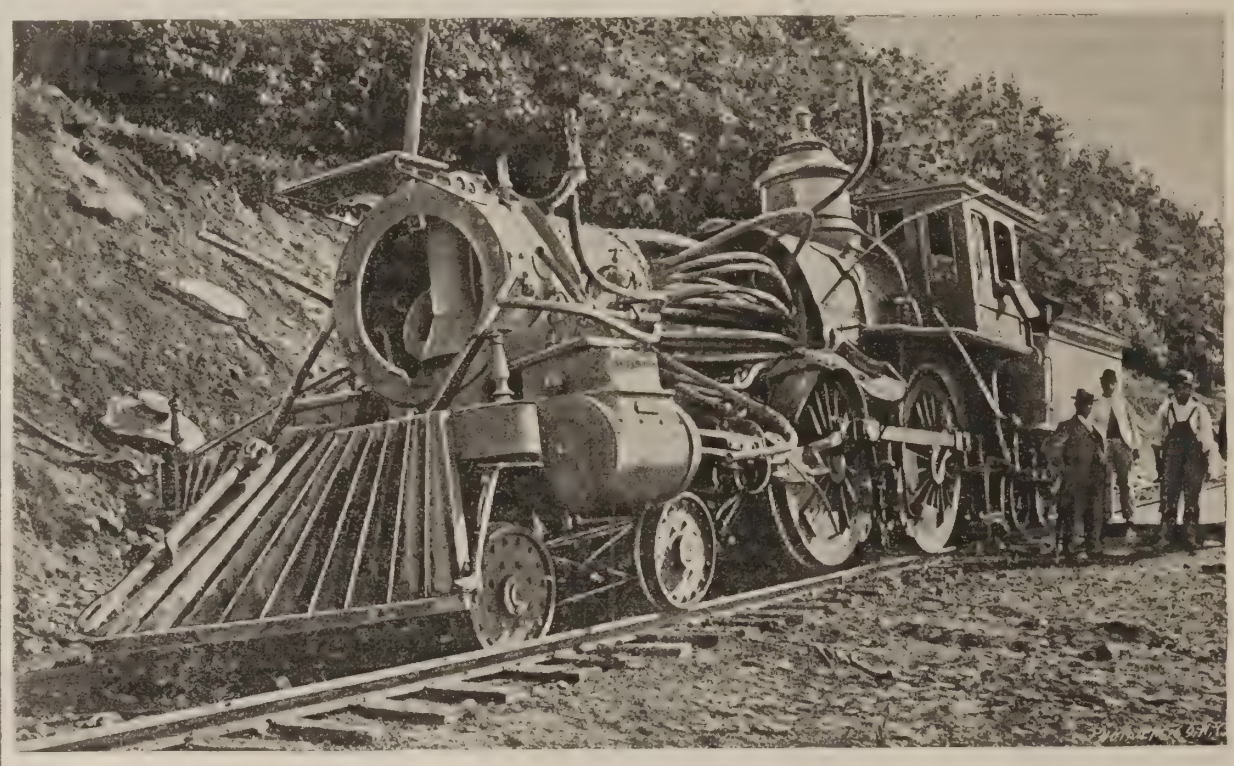
Mr. Henry S. Billings, Eastern Superintendent of the Pullman Palace Car Company, died at his residence in Hornellsville, N. Y., on Nov. 7. Mr. Billings was a remarkably popular and successful superintendent. He had the reputation among all with whom he was associated as being a man of a remarkably clear head and cool, deliberate judgment. He was a strict disciplinarian, as is evidenced by the high class of service performed by the employés under his charge, and while he would not permit any deviation from the strict line of duty, at the same time he was emiently kind-hearted, and was looked up to and consulted by many of his men almost as a father would be. Like so many other successful men, his early life was spent on a farm, from which he entered transportation service as a coach driver. In 1865 he begun railroad work as a sleeping car conductor with the old Erie and Atlantic Sleeping Car Company, where he rose to be superintendent. When the business of that concern was assumed by the Pullman Company Mr. Billings, who had demonstrated marked ability as a manager, was put in charge.

Mr. John Scotti, the reputed inventor of the locomotive cab, and one of the oldest engineers in the country, died of heart disease at Baltimore, Nov. 2. He was seventy-one years old. He learned his trade as machinist in the machine shops of the Baltimore & Ohio Railroad, and when he was retired four years ago he had been in the service of the company for over half a century. Mr. Scotti was an engineer for about twenty-five years, and distributed for Professor Morse all the material used in the construction of the first telegraph line. In 1836 he had charge of the engines Traveler, American and Antelope, built by Charles Rieder and designed by P. Davis. In 1837 he invented the locomotive cab. In running their locomotives the engineers were, up to that time, exposed to all kinds of weather. Mr. Scotti made applica tion to the officials to allow him to build a cab. At first they objected, thinking it would be an unsightly object, but finally they consented. The first one was a crude affair, but improvements were made gradually, until the present cab was developed. Mr. Scotti was also the inventor of the "copper-wire joint," with which all locomotives are now provided. In 1838 the steam whistle was invented, and was first sounded on a locomotive by Mr. Scotti. Formerly the bell was used to frighten cows and other animals off the track. Though the whistle then used could not be heard for more than two squares, it was regarded as a success. In 1876 the Baltimore & Ohio Company placed Mr. Scotti in charge of its locomotive exhibit in the Maryland Building at the Centennial Exhibition at Philadelphia. At one time he was foreman of the shops at Piedmont.

Locomotive Boiler Explosion.

Annexed engraving gives a striking view of a form of accident that has been fearfully common on railroads during the last few months. The engine belonged to the eastern part of the Delaware, Lackawanna & Western Railroad. The occurrence is thus described in a local paper:

"A terrific explosion of a locomotive boiler occurred at the Waterloo depot on Monday afternoon, and although the platform in the vicinity contained a large number of people, all escaped injury of even a severe character. The engine was the "Morris," attached to the Easton mail train, going East, which arrives at that station a little after 2 o'clock. Edward King, the regular engineer, who was feeling sick, had gone into the baggage car, and another engineer, named Cook, who happened to be on the train, was taking his place in the cab. The Sussex train had run into the station but a few moments before, and the passengers who expected to take the Easton mail were on the



upper platform. Some two hundred people were about the station, and of these it is thought fully one-half were on the upper platform where the mail runs in. The mail had come to a full stop, and perhaps half a minute later there was a dull thud, and the air was filled with pieces of flying machinery. The boiler of the great engine had burst in the cylindrical part and blown its equipments in every direction. The train kicked back but two or three feet, and the cab was only shattered, showing that the greatest force of the explosion had been forward and to the side opposite the platform, where the foliage of the trees for a distance of 300 feet still show the effects of the steam and boiler sediment thrown in that direction. Engineer Cook escaped entirely unhurt, although his coat was torn up the back. Fireman Burns, who was about to alight, was thrown to the lower track, but only injured one of his hands. The narrow escapes among the crowds of people were something wonderful, considering the missiles flying about them. One heavy piece of iron struck the platform just in front of a lady and child with such force as to break through a heavy plank."

After giving some more unimportant particulars the writer proceeds to theorize on the cause of the explosion, and quotes some fanciful views of a mining engineer about accumulation of heat inside the boiler which suddenly converted the water into steam. Nothing but similar far-fetched theories could be made out to account for the explosion. We would like to venture another theory to the effect that the plates which gave way were not sufficiently strong to resist the working steam pressure to which they were subjected. This might happen in several ways. The plates may have been of inferior material having a local weak spot which started the rupture. It may have been a good sheet weakened by bad workmanship or by corrosion. The initial rupture evidently began on the waist sheet of the wagon top. In many locomotive boilers the wagon top is a dangerously weak part. Men will design a boiler with a shell 52 inches diameter and calculate the strains for that and then make the wagon top 60 inches diameter. The barrel of such a boiler will probably have a fair margin of safety and the wagon top will have none worth mentioning. It is exceedingly difficult to figure out the safe resistance of the sheets of a wagon top; but we are persuaded that many boilers of this type have very little between them and disaster.

A certain engine on a Texas railroad seems to have as many lives as a cat. It went through the Guadaloupe bridge the other day, and executing a somersault, landed on a small sand bar, the only soft spot in the river. The nine cars which went with it struck the bed rock and were smashed. The engine will be repaired and again go on duty. It has been in three collisions and two wrecks, and has been turned over twice. Its original number was 40, but this was changed to 90 to break the bad luck. It will now probably be given an odd number.

As the limited express train on the New York Central was nearing Peekskill, N. Y., Oct. 8, the side rod on the locomotive broke and the side of the cab and some of the machinery of the locomotive were broken by its rapid revolutions. In addition the forward right hand driving wheel broke off from the axle and in this condition a dispatch states that the locomotive ran for a quarter of a mile without leaving the track before it was brought to a stop by the plucky engineer, Michael Cone, who stuck to his post. The passengers raised a purse of $50 for the engineer.

The largest tree in the world has been found again. Advices from Fresno, Cal., say: The largest tree in the world has just been discovered in Fresno county. Frank Loomis, an old mountaineer, and party returned to-day to Sanger from a bear hunting expedition in the Sierras. They wounded a bear, and in pursuing it ran across a big tree in the most rugged portion of the mountains, about two miles north of Kentucky meadows. This monarch of the forest was circumscribed by a radius of a mile or more of almost impenetrable underbrush, so that the hunters were compelled to use both knife and axe to reach the center. It is certain that no man has ever traversed the same ground. The tree was measured about four feet from the ground, and a rope of 129 feet 5 inches long was necessary to span its circumference.

The firm of H. K. Porter & Co., of Pittsburgh, locomotive builders, has voluntarily reduced the working hours of its employés from 10 hours to 9 hours a day, and has continued the old rate of pay, and has considered as extra time one hour of each day for the six weeks preceding the notice of the change. The notice was a surprise to the employés, and such a change had not been thought of among them. Soon after the notification was received from the firm the employés organized a mass meeting, which was attended by all the men, and a letter was written to the firm to express their appreciation of their generous action; to thank them and to "assure you that we will endeavor by diligent and faithful service, by careful attention to the details of our various occupations and by constant effort, to improve the quality and increase the amount of our daily output, to still further deserve your confidence in us, and to repay you in some degree for this and previous acts of friendship." The employés give special credit to Mr. H. M. Sprague, the Superintendent, for his efforts in their behalf.

Among the multitude of good things said by Mr. Depew in his address at Pittsburgh, this may be singled out as meriting a second reading: "That the fireman can become a locomotive engineer, the locomotive engineer the master mechanic, the master mechanic the superintendent of motive power, the superintendent of motive power the superintendent or general manager of a railway, and possibly its president, is the law of our American development and the source of our national pre-eminence." Mr. Depew rarely fails to hit the nail on the head. In this sentence he has admirably set forth a principle that bears upon every department of our complex life. It applies with equal force to all other vocations as well as to that of the railway man. The last may be first; the lowest may become the highest; the canal boy may be elected president —this is a rule of universal application in America. It is a rule full of cheer and encouragement to the young and ambitious especially, but contains a fruitful lesson for those who have had years of experience. Faithful, honest, painstaking work tells everywhere and always.

Communications.

The Buffalo Joint Inspection Plan.

Editor National Car and Locomotive Builder:

In answer to Progressionist, whose article is somewhat lengthy, and in support of the Buffalo plan, which I think can be demonstrated to be the most advantageous, cheapest and will give the best results as to despatch and safety :

In the first place, let us consider why joint inspection was established. Was it not with an idea that one man having had sufficient experience could make intelligent decisions in all cases of doubt, his decisions to be final? This would do away with the friction caused by the delivering and receiving companies each having representatives to satisfy. Now the mixing up of car foremen, inspectors and arbitrators would be a step so far backward as to almost land you in the place from which you started, and must be ever looked upon as a retrograde movement to any one versed in the objects of joint inspection and who has had experience in the Buffalo system. Progressionist says it is necessary to have two inspections. Why is it necessary? Cars in transit will average one inspection every 24 hours.

If cars were to go on a journey of a month or so without being looked at, this extra precaution might be necessary. It is also stated that the finding of defects in the second inspection would much more than pay the Chief Inspector's salary. What is meant by this? Does it mean that by sharp practice or extra vigilance he will outdo his competitors to this extent? If not, I should say all would be equal. Now, instead of the Detroit plan being the cheapest, the idea of its not requiring a massive brain to see it in that light must be taken with several grains of salt. For example, it is the general rule, that railway companies deliver cars in one yard and receive in another ; the Detroit plan requires inspectors in each yard, which, would make just double the amount required by the Buffalo plan, to say nothing about the delay and settlement of disputes, and responsibility of repairs, especially in the second inspection which, as I understand, only the chief inspector could determine. Having several roads to look after he would not, in all probability be in the yard when required. The Buffalo plan does away with all these annoyances and delays, as all cars are thoroughly inspected and repaired before being delivered, and are ready as soon as oiled to go forward in a train, and as accidents and delays are down to a minimum caused by defects overlooked by inspectors. In fact, each inspector is held responsible for all cars passing through his hands, whereas in the Detroit system the responsibility is divided up between the two sets of inspectors. Referring to the one-man or Czar power as Progressionist puts it, it is just what is required to carry out the intention and design of joint inspection, and is the only way it can be done successfully. If he had to take instructions from every representative of each company and try to carry them out it would be simply impossible, but when all the companies issue a joint order, inspectors are notified, and it can be done to the satisfaction of all.

J. C.

About Brick Arches.

Editor National Car and Locomotive Builder:

Can you give me any information in regard to the putting in of a brick arch? I have seen considerable discussion in regard to the advantages as well as disadvantages of the brick arch, and I think the advantages overbalance the disadvantages. Now, during all the discussion, pro and con, I have never seen where anybody has given any rule for putting in the arch. It seems to me there should be a rule for this purpose. Now, if there is will you give it me? I will ask you the following questions and hope for an early answer: What should be the length of a brick arch in comparison with length of fire-box? What length of arch should be put into a 60-inch fire-box? How much of a space should be left between forward end of fire-box and arch? Should the lower side of arch be even with lower flues or upper side? What should be the elevation of the arch? Should the under side of brick nearest to furnace door be on a level with top of door?

AMOS JONES.

[There is great diversity of practice in the construction and setting of brick arches. A common length is 36 inches, set at an angle of 55 degrees from the flue sheet, the bottom point being flush with the bottom of the lower row of flues. Some master mechanics support the arch with flues, others with an angle iron, and others again merely with studs screwed into the side sheets. A man thinking of applying a brick arch ought to send to roads using the arch for drawings.—EDITOR.]

The Coupler Status.

Editor National Car and Locomotive Builder:

In the November number of your valuable paper you make mention that the members of the Time Convention endorsed the Master Car Builders' coupler. It may be of interest to your readers to let them know that the switchmen, who have the best means of judging the practical working of couplers, condemn the hook form, and that the Train Mens' Association have done the same thing. No man can be much in freight car and repair yards without being convinced that the breakage among the M. C. B. couplers is simply appalling. The experiment of trying the M. C. B. coupler is not at all encouraging for its friends. Considering the present state of affairs, would it not be a wise plan for the purchasers of couplers to pause and count the cost of forcing an unmechanical pattern into use?

TRAVELER.

Boiler Seams.

OMAHA, Oct. 20, 1890.

Editor National Car and Locomotive Builder:

On reading the JOURNAL for October and seeing your article on Boiler Explosions, I began to think of the practice on the Chicago, Milwaukee & St. Paul Railroad. I visited the West Milwaukee shops in May last, and saw in the boiler shop a new stationary boiler with double seams in the circle and single seams with welts, as per sketch, on the straight seams. I asked the foreman why that was as I thought that in these days of high pressure they were making the straigh t seam the strongest. He said the double seam with welt was too stiff and caused the plate to crack there. Then I asked why he put a double seam on the circle; as he was busy he did not answer and went off, thinking perhaps I was asking too many questions. What I would like to know is how this seam can be stronger than the double seam with welt as he claims; or is it as good or better than the Jerroll seam?

PATRICK FARLEY.

[Our correspondent, who is a practical boiler maker, sends us a sketch showing a single riveted longitudina welt seam with ⅜-inch-welts put in with two inch pitch. There are three extra rivets set in the form of a triangle every ten inches taking in the outside of the welt plates. We do not think the plan so good as a double riveted seam. The trouble of the welted joints causing cracking at the edge of the seam results from bad design, and if the inside welt plate extends further than the outside plate, there is no cracking.—EDITOR.]

Book Information on Mechanical Matters.

A correspondent writes us:

Will you please inform me where I can get a book or paper, or set of papers that will tell me how to put locomotive drivers in tram to tram truck frames, hang crossheads and guides? I have Sinclair, Alexander, Roper, Dempsey, Clark, Edwards and Colburn. I read the NATIONAL CAR AND LOCOMOTIVE BUILDER, also *Locomotive Engineer*, and *B. of L. E. Journal*, and cannot get the information. Any information you can give through your paper in answer will be thankfully received by one trying to climb the ladder to distinction. I am considered a good machinist, and want the work for reference on general round-house repairs.

[We regret to say that we cannot at present help our correspondent. There is no book in print that describes the operations he wishes to learn about, and a press of other matters prevents us from taking up the subject of round-house repairs. There is need for a plainly written treatise on the repairing of locomotives, and we have no doubt that a work on the subject would find a ready sale Books might be written to give valuable facts on the questions referred to by our correspondent, but the greater part of the work calls for manipulative skill that can be acquired only by actual practice. Machinists may obtain valuable information about their business from books and journals, but the refinements of the trade must be learned in the shop.—EDITOR.]

Knowledge Needed by Railroad Men.

COLORADO CITY, Colo., Nov. 10th, 1890.

Editor National Car and Locomotive Builder:

In the last number of the NATIONAL CAR AND LOCOMOTIVE BUILDER is an article wherein it is mentioned that the brakemen, at their last convention, recommend the link and pin as the best form of car coupling. The following is a conversation which ensued between two yard men because two draw-heads of the M. C. B. type would not couple:

The _____

_____won't couple ! ! !

After slacking ahead and backing against the train with sufficient force to rack every draft timber in the train, the link and pin were unanimously approved as being the best thing that could be gotten up———. Had the knuckle been released and placed in a "coupling" position, it would have increased the chances of the Y. M. for eternal happiness in the next world, to say nothing of a dividend to the stockholders in this ! But this is only an instance wherein a little instruction would be beneficial.

The writer was a passenger on a train that was running 38 or 40 miles per hour when the leading wheels of a sleeper left the rail; the train was hauled 1,200 yards in this condition; when it reached a switch the sleeper of course was derailed and the car ahead was thrown down an embankment; but fortunately no one was seriously hurt. The train conductor was in the head coach while his brakeman and the Pullman conductor were pulling on the automatic signal cord, supposing this to be the conductor's brake valve. (The automatic signal is used on this road). This passenger brakeman had been conductor for 15 years, but evidently was not sufficiently interested in his business to distinguish the difference between the two cords.

On the same trip could be seen another trainman "bleeding" a coach, because the hand brake was set. This on one of the most foremost air roads in the country.

If officers adopting new devices were to see that those using them partially understood the mechanism I am sure much more favorable results would be obtained.

I am not interested in any form of drawhead; but it is my opinion that the one that does not require the men using it to "pack iron" and look for pins and links on a snowy night is the proper caper.

A READER.

Need of Brake Piston Travel Indicators.

Mr. P. H. Griffin, of the New York Car Wheel Works, Buffalo, lately contributed a long letter to the New York *Tribune*, discussing an article by Mr. Angus Sinclair on Failures of Air Brakes, previously published in the same journal. After describing the brake gear and its method of working, he points out the fact that a brake may be in perfect order yet fail to stop the train if the brake cylinder piston has reached the end of its travel. He continues:

When the connections are adjusted with new brake shoes, and everything in proper order, a piston travel of four inches will apply the brakes. As the shoes wear out or the connections give under strain or wear at the pivotal points, the piston travel must necessarily increase to effectively apply the brakes. The wear of brake-shoes is rapid, and the total effective travel of the piston is more than exhausted in the wearing out of one brake-shoe. Constant attention must therefore be given to the connections to see that they are of proper length, and inspectors at certain points have this work in charge. As a rule the work cannot be done until trains are all made up and ready for departure; the air pressure is then applied, the travel of the piston watched, and if it is too great the piston rods should be shortened, in order that the brakes may be applied with less piston travel, and a margin of safety provided to allow for wear. The very short time available for this work, the hurry and confusion incident to the departure of trains, and the pressure to gain every moment of time in this age of minutes and seconds, are serious obstacles to a proper performance of the work; unfortunately, it cannot be done at any other time unless every car is taken to some point provided with apparatus for making a test, a practice almost impossible when the great number of cars in service is considered, as well as the one that drawing-room and sleeping cars are often in service constantly for months at a time.

The reports of the Michigan Central Railroad show that 2,316 cars passed Windsor, Ont., in the year 1889 with the pistons of air brake cylinders travelling twelve inches; on such cars absolutely no braking power was obtainable.

Nearly all of these were sleeping cars running through from distant points, the inspection and care of brake attachments being given by different railroad companies in transferring the cars across the river from Detroit to Windsor, and vice versa, time was afforded for testing the piston travel, and a record taken with the above result. I do not know of any other railroad company making a systematic record of the kind. During the last year the Michigan Central have equipped their cars with indicators, operating automatically, that show the exact condition of piston-travel at all times. When the indicator is used the maximum travel of the piston is always shown, and the necessary alteration to take up wear can be made at any time. From a careful investigation of the subject on many of the leading railroads of the United States and Canada, I have no hesitation in saying that on one-quarter of all cars in service the braking power is so small as to be absolutely useless in case it is necessary to make a sudden stop, for the causes given above. In every-day practice it can readily be seen that in making the usual stops an engineer can handle his train without difficulty; he knows perfectly the control he has over it, whether a moderate pressure will suffice, or whether extra pressure must be used. The latter is always dangerous, through liability to stop and slide wheels with entire loss of control. But when danger confronts him and he must strain everything for an immediate and unexpected stop—well, we know they are not always made, and that the difference of a few hundred feet has a terrible result. Investigation follows; it is said that "the air-brakes failed to work," and that is the end of it. I firmly believe if the attachments through which the air-brake does its work were always in proper condition accidents from this cause would be very rare.

The conditions of service above explained are in no way attributable to any feature of air-brake construction or application. The manufacturers of air-brakes have been indefatigable in their efforts to improve and perfect their devices. Without their labors it would be absolutely impossible to run trains at the speeds in practice to-day. It is only just to them, therefore, that accidents so commonly attributed to the failure of the air-brakes should be located where they belong, and that every effort be made on the part of railroad managers to supplement the valuable appliances now obtainable with every safeguard that can be found for their effective use.

Joint Inspection at Interchange Points.

The following circular has been issued by the committee of the Master Car Builders' Association appointed to investigate the above subject:

1. At how many points on your line is a system of joint inspection for freight cars in practical use?

2. Which of the following systems of joint inspection have you in use on your line, and which do you prefer for points where there is an interchange of over 100 cars per day?

(A) A chief joint inspector, with entire charge of the inspectors, who hires and discharges them, the inspectors being subject to him only, and being paid pro-rata by the different roads.

(B) Each road to hire its own inspectors, a joint inspector to have charge of them as to the inspection of cars, and to be entirely responsible for the inspection at that point; but the inspectors to be subject to their respective car foremen when not inspecting cars. The car foreman to hire and discharge them.

(C) Each road to hire its own inspectors and do its own inspection, subject to the orders of their respective car foremen, who are responsible for the inspection for their respective roads, the joint inspector merely acting as an arbitrator to settle disputes between the car foremen.

3. Have you, on points on your line where there is an interchange of over one hundred cars per day, any system of joint inspection not included in the above? If so, please describe the same.

4. Would you recommend, at points where there is an interchange of less than one hundred cars per day, that the cars going each way be looked over by an inspector of each road at the same time, rather than be inspected by each inspector separately, one way only.

5. Have you in use at joint inspection points, any rules other than the M. C. B. rules, or additional to those? If so, and consistent, please send a copy of the same.

6. In your opinion, would the difficulties at inspection points be reduced if all cars delivered by the owning road to the connecting road were carded by the owning road for all material defects, either old or new, which exist on their own cars?

7. Would you recommend, for the use of inspectors and the securing of uniformity in inspection, a fuller interpretation of the M. C. B. rules, showing by description and illustrations, how far defects in timbers, castings, iron work, etc., may be allowed to exist, and be accepted as "safe to run"?

8. Do you use any special blanks for reports to be made by joint inspectors, of defective cars received or delivered? If so, please furnish samples.

9. If you do not now have any forms as above in use, would you recommend the use of such reports by joint car inspectors? If so, what information should such reports contain?

10. At joint inspection points, would you recommend that the decision of the joint inspector be final and binding, or would you advise the allowing of an appeal from such decisions, to some standing or special committee, appointed by the roads participating in the joint inspection at that point?

11. In order to bring about and maintain uniformity of inspection on all the railroads in the M. C. B. Association, would you recommend the appointment of district joint inspectors, with duties and jurisdiction as follows:

(A) To have supervision within their districts and to visit regularly, the various joint inspection points and settle disputes as to liability between railroads and joint inspectors.

(B) To educate the joint inspectors in the matter of the proper interpretation of the rules of interchange, and secure uniformity of practice, thus avoiding delays now occasioned by inspectors at distant points deciding differently in relation to defects existing in one and the same car.

(C) The jurisdiction of the district joint inspectors to be determined by the division of the United States and Canada into districts, on the basis of car mileage and traffic.

(D) Disputes between district inspectors, or appeals from the district inspectors' decisions, to be decided by the executive committee of the M. C. B. Association.

A. M. WAIT, *Chairman*,
H. C. MCCARTY,
SAMUEL IRVIN,
HARVEY MIDDLETON,
WILLIAM GARSTANG.

Answers to questions in the above circular to be sent prior to Jan. 1, 1891, to

A. M. WAIT, Ass't Gen'l M. C. B.,
Lake Shore & Mich. Southern R'y,
Cleveland, O.

New York Railroad Club.

A business meeting of this club was held at the Gilsey House, New York, on Nov. 20. A goodly number of railroad men were present and a spirit of interest manifested that promises to put new life and vigor into the club. Mr. R. C. Blackall presided and Mr. H. G. Prout acted as secretary. Considerable formal business was transacted, the principal part being election of officers for the ensuing year. The officers elected were: President, Ross Kells, New York, Lake Erie & Western; first vice-president, R. C. Blackall, Delaware & Hudson Canal; second vice-president, W. L. Hoffecker, Central of New Jersey; third vice-president, Frank S. Gannon, Staten Island Rapid Transit; secretary, H. G. Prout, *Railroad Gazette;* treasurer, C. A. Smith, Standard Oil Company. The executive committee are: John S. Lentz, Lehigh Valley; Wm. Buchanan, New York Central; W. H. Lewis, Delaware, Lackawanna & Western; H. S. Hayward, Pennsylvania, and Thomas Aldcorn, West Shore. The finance committee consists of E. H. Andress, J. H. Bailey and S. W. McMunn.

Swing Beam Trucks.

At the October meeting of the Western Railway Club the discussion of the above subject was continued. Mr. W. Forsyth said in regard to the relative wear of rigid center and swing beam trucks: I do not believe there is any definite information on the subject among railroad records. The railroads do not keep a separate account of truck repairs as separate from car repairs, and I do not see therefore how it is possible to make any statement of the relative cost of maintaining swing trucks and rigid trucks. The case is similar with the other part of the question, that is, what has been observed as to the effect of these two trucks on flange wear; because there have been no separate accounts kept by the railroads of the flange wear of the different trucks. Where master mechanics do take notice of these points, and where the observation is made, is in the case of engine trucks. There they notice a great deal more closely what the cost of repairs is, and how fast engine trucks are wearing out. It was a gentleman's testimony at the last meeting that swing beam trucks on engines would wear out rapidly, and that the cost of maintenance was large, and that it was probable that a rigid truck would be a better type for engine tender trucks, at least, for the passenger trains, because they get such severe service and run faster than in freight service, and consequently wear out more rapidly. Four or five years ago we decided to abandon swing-beam trucks for our passenger engine tenders, and ever since we have used rigid trucks, and they give us very good service. The repairs are very small as compared with those when we had swing-beam trucks. In regard to cars, Mr. Rhodes explained at the last meeting, concerning our practice, that, although we have perhaps 6,000 swing-beam trucks on our road, when the proposition came up to change to a rigid truck there was no opposition made on the part of any of our master mechanics; that they had concluded that the cost of maintaining the swing-beam trucks was so much greater than that of maintaining the rigid truck, that they all favored changing them.

The secretary read a letter from Mr. J. C. Barber, of the Northern Pacific, describing a very substantial form of swing-beam truck which he had invented and patented.

Mr. C. A. Smith said: I have studied the subject of trucks for years, and at one time was very much inclined to favor a swinging motion truck. I tried to find out that it was the best truck in the world, and the more I did so the worse off I was. I believe in as simple a truck as possibly can be made, and I do not see where there is any advantage that the swing motion truck has over the rigid one. Many people have talked, train men and others, of the starting of the swing motion truck on a curve. They say they can start more cars on a curve or draw along more cars around a curve with the swing motion truck than they could without it; but I judge that most of that is guess work. The swing motion truck has more parts than the rigid truck and certainly must cost more for repairs.

Mr. Gibbs: We (the C. M. & St. P. Ry.) are in favor of the swing-beam truck, and I will say a word from my point of view about the wear of flanges. I have not been able to secure any definite information about it, but I have talked with our master car builder—an observing man—and he says that he is of the opinion that a swing motion truck causes less flange wear than a rigid truck. We have a swing motion truck designed for use on modern cars. The roads have adopted a rigid truck for all their large capacity cars, thinking it more advisable to use that in a large car loaded beyond its capacity; at all events, either from chance or conviction they are now using the rigid truck. To-day they are running cars which are loaded above their marked capacity. When swing motion trucks are used under such cars they are failures. Mr. Smith says that he cannot see why we should be able to haul more cars on a curve with a swing motion than a rigid truck. I do not think we could myself. Mr. Wellington mentions the fact that the swing motion truck relieves the blow on the side of a badly lined track, but otherwise perhaps increases it by prolonging the effect. That effect is of course perceptible in any long train of cars. You strike a piece of badly lined track and the tendency is to pull the whole car over to it, and also to have the car immediately in front and in the rear pulled in like manner. I believe that there is more necessity for a swing beam truck on freight trains than in passenger trains, probably from the fact that you have more in the train.

Mr. Allen Cooke: With our cars that had swing motion trucks, we have had a great deal of trouble. I think these trucks work very well until you get 40,000 pounds on them; then I think they will swing over to one side, and stay over there. Then they draw very hard; much harder than rigid trucks. If you make a swing-beam truck to carry more than 40,000 pounds you have to make it very strong, and it is costly and heavy; we have a great deal of trouble with our hangers, and the axles bend.

Mr. C. A. Schroyer believed that no saving in wear of flanges was effected by using the swing beam truck, but he thought the cars pulled easier.

Mr. J. N. Barr admitted that the swing-beam truck was more expensive to make than the other, but he believed that a saving would be effected in the cost of repairs, as the softer motion of the swing-beam truck did not work nuts and bolts out by vibration. Believed the swing bolster a good mechanical contrivance, and that its action saved wear of wheels.

Mr. Gibbs mentioned a case where he saw a freight train passing a curve on a badly surfaced piece of track, and he could have told with his eyes shut every rigid center car that passed on account of the blow it struck the rails.

Mr. Mackenzie: I don't know much about swing-beam trucks on freight cars, but when we take an engine with a train going around a curve at the rate of 50 or 60 miles an hour, and have the engine riding around without any apparent oscillation—which you can with one of those rigid trucks—you don't have to tie yourself on the seat and hold yourself there; but with the swing-beam truck that I had at one time, you had not only to hold on, but you had to get off your seat to do so. That swing-beam truck was a very long one, I think some 18 inches, and the oscillation was very great. We took these trucks out and put in the rigid trucks, and we do not have any further trouble with flange wear on the driving boxes.

Mr. Rhodes: Mr. Mackenzie has said he has no figures in regard to the extra cost of the swing-beam over the rigid, and Mr. Barr has also said that so far the problem appears to be largely based on the question of cost. I have some figures here which give this difference in cost. The difference in cost between a swing-beam truck on the C. B. & Q. road as we formerly constructed it, and the rigid truck as we now construct it, is $3.50 per truck. That on an order for one thousand cars would mean $7,000. Now the figure is large enough, and it seems to me it is one which railroads will do well to consider, in placing orders for cars. The first cost of one over the other is considerable; but it is not the first cost that has induced our road to make the change; it is the cost for repairs. We have found that the portions that convert the truck into the swing motion truck are those that are constantly needing repairs; they require more repairs than any other part of the truck—that is, the short axle and the hangers. I expect to make as much of a saving in the repairs of our rigid trucks over the swing beam as we do in the first cost.

Mr. Barr: We use the 3 × 3 inch swing-beam axle for our 60,000-pound cars, and I don't think that we would be put to any expense from the axles bending. There is a certain amount of wear there that will have to be attended to in the course of time, and some years ago to obviate that trouble swing trucks were built with simply a strap passing under the swing-beam. My experience with straps has been that after they have been run a number of years they commence to develop a crack in the corner and break. I believe we are better off to use the old axle and replace it when it wears to a certain limited size. It is possible that it costs more money to maintain the swing-beam truck than the rigid truck, but I don't think that anyone should feel altogether clear in saying absolutely that it does, unless he has actual figures to show it.

Mr. Gibbs—Several persons here and at other times have argued with Mr. Mackenzie that, because the rigid truck on a locomotive rode better, therefore it would when applied to cars. I beg to differ with the opinion that the case is the same. The leading truck on a locomotive has a somewhat different function from the truck on the car; it is intended to guide the locomotive when you strike a turn or a curve; the car trucks guide the cars, but the train is already pulled around the curve. You don't want the body of the car to follow any inequality in the track; you want to equalize that if possible.

Mr. D. J. Durrell, Illinois Central, made some points in favor of the swing center truck based on his experience on the Union Pacific.

The discussion was continued at some length, but no more points of interest were elicited.

At the November meeting the subject of swing beam *v.* rigid trucks was brought up again for discussion.

Mr. Cloud gave particulars of tests he made some years ago to ascertain the relative resistance of locomotives having swing leading trucks and rigid trucks, and it was found that the swing truck caused the greatest resistance.

A long letter was read from Mr. D. J. Durrell, mechanical engineer of the Illinois Central, in which some points were made in favor of the swing beam truck. He held that the wheels of swing motion trucks did not press upon the side of the rails so much in passing curves as the wheels of rigid trucks. He held that with properly constructed swing beam trucks, the wear of wheel flanges could be almost entirely prevented. He afterwards submitted a statement that out of 632 wheels removed at Chicago by the Illinois Central only 11 were removed for sharp flanges. It was shown that 201 of the wheels were removed through being slid flat.

Mr. J. N. Barr argued that sharp flanges were not generally caused by defects of the truck, but that the condition resulted from defects in the wheels themselves.

At the November meeting of the New England Railroad Club Mr. F. D. Adams, of the Boston & Albany opened a discussion on "The Economy and Safety of Swing-motion Trucks as Compared with Rigid Trucks." His company had always built rigid trucks, and he naturally favored that form, but he had tried to divert his mind of prejudice in considering the two forms. He dwelt at considerable length on the details of construction of the various forms of swing motion trucks, and considered that they were not so safe as rigid trucks, and that they were more expensive to keep in running order. He thought, however, that the swing motion truck carried the load easier than one resting on rigid centers.

Mr. J. W. Marden agreed in a general way with Mr. Adams, but he thought that if swing motion trucks were built properly they could be made as durable as rigid trucks. He had found from experience that cars with swing center trucks carried fruit to market in better order than cars having rigid trucks.

Mr. Adams mentioned that he had steel-tired wheels under some freight cars, and he could not perceive that there was any difference in flange wear between the wheels of swing beam tracks and those under the rigid truck. He believed that the Jewett device of friction rollers would decrease the flange wear, as the slightest touch upon the flange would move the truck. Referring again to this device he said: I have referred to Mr. Jewett's device. He has a large center plate with friction rolls in it, so arranged that they roll properly on the center, and also his side bearings are on the same principle, and the very slightest motion will roll them around, and with almost any weight you can put on. It can be applied to a rigid motion as well as a swing motion truck, and we need that kind of anti-friction movement on any truck. I have not taken the ground that the rigid truck was the best; I simply say that with the experience we have had I am led to the conclusion that the swing motion truck, as it has been generally built, is not as safe or economical as the rigid truck as it has been generally built.

Mr. J. T. Gordon, Concord Railroad, said: We build nothing but swing motion trucks now for our cars. We make a link for the hanger, which is 1¾ × ¾ inch, with the best iron we can buy. The axle under our spring plank is 3 × 1⅛ inches, and in my experience, about 10 years, I have never known of an axle breaking. We put a casting on the top, which takes a good deal of the wear off the axle. I have no doubt a rigid truck can be built cheaper than a swing motion truck, but if I were going to construct a rigid truck I should want a center bearing somewhat different from most that I have seen.

Mr. J. B. Fletcher, National Dispatch Company, favored the use of swing beam trucks and held that freight was carried in better condition above swing beam than above rigid trucks.

Mr. COUGHLIN: There is ease to a car and the track in a properly constructed swing motion truck. Some of our officers were of the opinion, when we put a 9 × 52 foot passenger car body on our road, that it had a tendency to swing more than a car 8 feet wide, and if they had fixed bolsters with everything fitted nicely there would be no shock to passengers when riding over the road. So I fitted up three cars for the officers as an experiment, that they might prove it for themselves. I blocked the bolster so as to have no lateral motion. The result was that the first trip demonstrated to them that their ideas were wrong as to the advantage of a rigid bolster and an absence of lateral motion of the journal in the journal bearing. When the cars were traveling rapidly, no man could stay in his seat. Now, if that be the case in a passenger car, why should not the same principle be carried out in a freight car? It seems to be demonstrated that there must be sufficient action to ease up the shock of any form of car.

Brake Power in the Old Colony Accident.

In their report on the Old Colony accidents the Railroad Commissioners say concerning the brake power of the train:

The cars ran about 540 feet after the engine struck the jack. The engineer testified, and there is reason to believe, that he applied the brakes to the train at least 100 feet from the jack. If such was the case the cars ran 640 feet after the brakes were applied, in spite of the fact that the engine ran 250 feet on the ties and was then embedded in the bank, and that, in addition to the brake power thus exerted, five cars and the tender were also derailed and ran over the ties for varying distances, the resistance being so great that their trucks were torn off. The baggage car ran at least 250 feet after derailment, and the cars behind it at less distances.

It is impossible to say whether the cars would have followed the same lines if their momentum at the time of the accident had been less than it actually was, or if the brake power had been greater, or in any way changed; but it is an impressive consideration, that, if the train had been brought to a standstill when the front end of car No. 263 reached the engine, and if the other cars had taken the course which they did take—or, in other words, had the train not gone the last 45 feet—none of the passengers would have been killed, or even seriously injured.

In matters affecting the safety of railroad travel, time and space are factors of the greatest importance. A speed of 30 miles an hour means 44 feet a second. Seldom has the importance of having a train supplied with the best and most efficient brakes been more terribly or more forcibly illustrated. If the brake power on this train could be increased so that the train could have been stopped 45 feet short of the place where it did stop, this accident might have been freed from all its horrors.

The train of the Old Colony Railway is known to have fallen short of an easily attainable standard in three elements:

1. The driving-wheel brakes on the engine were arranged to be operated by a different handle from that which operated the brake on the train. From the evidence, it seems probable that the engineer failed to apply the driving-wheel brakes. There is no doubt that he applied the brakes to the train before he struck the jack; and, if the same movement had also applied the brakes to the driving wheels, it is clear that the train would not have gone as far as it did.

The weight on the drivers was not far from 50,000 pounds, the total weight of the train about 600,000 pounds; so that a loss of 8 per cent. of the available brake power resulted from the failure to apply the driving-wheel brake, which failure was due to the fact that the driving-wheel brake and the train brake were arranged to operate separately. The engine went 280 feet after striking the jack. It probably went 380 feet after the train brake was applied. Other things being equal, an increase of 8 per cent. in brake power while the train was going 380 feet would have resulted in shortening the stop 28 feet. The best practice is to unite the train brake and the driver brake in one system. The argument in favor of uniting them has been that, if the driving-wheel brake is operated by a separate handle, unused in ordinary stops, it may not be applied in an emergency, either because the apparatus is out of order, or the engineer does not have time, or in the excitement of the moment does not think. That the argument is well founded is confirmed by the circumstances of this accident.

2. On the six-wheel trucks on the Pullman car only four wheels were provided with brakes; therefore on that car one-third of its braking power was not utilized. The Pullman weighed about 80,000 pounds, or about 13 per cent. of the whole weight of the train. One-third of the weight of the Pullman, or 26,000 pounds, being between 3 and 4 per cent. of the whole weight of the train, was destitute of brakes. If the Pullman car had been fitted with brakes on all its wheels the train would not have gone so far as it did.

3. Only three cars in the train, namely, the Pullman, and Nos. 333 and 326, the second, the seventh and the eighth cars were fitted with the latest form of quick-acting brake. Had they all been fitted with such latest form, which has now been in use for several years, and is amply approved by use, the brakes would have been applied more quickly than they were. Though the saving in time in the application of brakes on an ordinary passenger train under the quick-acting system is small, nevertheless it is appreciable, and the result must be a quicker stop. The accidental distribution of the cars fitted with the quick-acting form was such that the application of brakes was undoubtedly quicker than if none of the cars had been so fitted, but it is probable that, if the whole train had been fitted with the quick-acting form of brake, the average saving of time in the application of the brakes would have been at least one second. On the forward cars it would not have been so much. On the rear cars it would probably have been more. A train going at the rate of 30 miles an hour runs in one second 44 feet.

It is clear that, had all the cars been fitted with the quick-acting brake, had all the wheels of the Pullman car been fitted with brakes, and had a single handle operated both the train brake and driving-wheel brakes, the train would have been brought to a stop more quickly than it was, and it is possible, if not probable, that all loss of life would have been avoided.

Locomotive Side Rods.

At the November meeting of the Northwestern Railroad Club, Mr. H. Higgins, of the Great Northern, read a paper on the best form of side rods for locomotives. He considered the various strains to which locomotive side rods are subject. The requirements of a satisfactory side rod were stated to be that it must be strong enough to resist the alternate thrust and pull, to which it is subjected in transmitting power from one wheel to another, without bending or buckling vertically, and must only allow a slight amount of spring or buckle horizontally under the heaviest work. And yet it should be as light as possible to do all this without creating stress, due to the centrifugal force developed when running at high speed.

Considering the best form of rod to meet these conditions, the author preferred the "fish back" rod as the best. He objected to the common rectangular section as making a bad distribution of the metal. The I-section rod was commended but considered too stiff sideways.

Regarding rod ends, he spoke of the various forms of securing the brasses, and expressed the belief that the solid end side rod is still in the experimental stage.

Mr. W. T. Reed favored the fish-back side rod, and considered solid ends preferable not only for side rods but also for the front end of main rod.

President McIntosh favored the use of solid ended side rods for 8-wheel engines. They anneal the side rods of their older engines. Preferred iron rods made from muck bar by a good blacksmith. Liked the fish-back form of rod. Thought solid ends might be used advantageously for the back end of main rods.

Mr. Church had known a strap rod run for three years without being touched, the brasses having been keyed brass to brass.

Mr. C. F. Ward wished that some member would try tempered copper as a material for brass with solid rods. He had used the copper on some cross-heads. The engine was turned out last June, and had been running ever since without any perceptible wear on the gibs. His belief was that a side rod does not break suddenly, but a crack starts and grows. Has established a practice of giving any engineer or fireman or wiper or other man who finds a crack in a side rod a quarter of an inch deep $10 extra on his pay, and it is a good practice. Up to date they have taken out eight rods with cracks of that depth, and have found deep fractures. Believed in annealing rods when they were overhauled.

Illinois Central Shop Order System.

Very important to railroad companies is the use of a simple yet comprehensive system of shop orders which will show with accuracy the cost of repairs without calling for the use of an expensive clerical force. The Illinois Central Railroad Company have in use in their various shops a system of shop orders which appears to be as good as anything we have seen. At the request of the NATIONAL CAR AND LOCOMOTIVE BUILDER, Mr. Henry Schlacks, superintendent of motive power, has sent us the following description of the system:

We have two kinds of shop orders. 1st. Standing shop orders, as shown on blue print attached, which embraces all of our regular work which is always in process of manufacture, and for which we have a standard price list. If at any time we wish to revise one of our standard prices, we issue a special shop order to do so. 2d. Special shop orders, which are issued to do all work not included in our standing shop orders.

The numbers of our standing orders are 2,050 to 2,069 inclusive, as shown. Our special shop orders start each year with number 2,100; by using these numbers we keep them above our engine numbers, which now run to 1,478 at this date. The special shop orders are made in consecutive numbers.

I attach our shop order blank filled out with an order as issued. This order is made by the storekeeper, where the material accounts are kept. It is then passed to the master mechanic for his approval, and a copy made of same in an indexed impression book for use of his office. It then goes to the general foreman, who places a copy on each shop foreman's book in duplicate, as shown on attached blank. When a foreman has completed his part, he fills in the date completed on both parts and returns one to the general foreman. When all foremen have returned their orders to him he fills in the date completed on the original shop order, and delivers to the timekeeper, who foots up the labor, and returns the order and amount to the storekeeper. The material is then footed and the labor added, which gives us the total cost of the work; thus we have only one bill to render, whereas without this system two bills are necessary, one of material and one of labor, and the material bill usually precedes the labor bill by one month.

This system gives us a correct price list, and by comparison of shop orders from the various shops for the same kind of work we can always tell which shop does the work at the lowest price.

The record of the storekeeper is kept in a journal, the heading showing copy of the order as made, one page for material, and the opposite for labor, total and remarks.

I attach a copy of journal of the sample order. This book is indexed, so that any order can be referred to at once.

Yours truly,

H. SCHLACKS,
Superintendent of Machinery.

ILLINOIS CENTRAL R. R. MACHINERY DEP'T.
WELDON, Aug. 13, 1890.

Foreman Machine Shop:

Sample. Have tires turned on two pairs drivers, and furnish new driving axles and crank pins, for W. Griffin, Clinton, on Car 21,925, and charge labor and material to Shop Order No. 2,168.

F. W. BAKER, *General Foreman.*

Date completed Sept. 25, 1890.

General Foreman:

Sample. Shop Order No. 2,168. Dated Aug. 13, 1890. For two pairs drivers for W. Griffin. Clinton, Ill.

Completed Sept. 25, 1890.

WM. THILLMAN, *Foreman Machine Shop.*

ILLINOIS CENTRAL RAILROAD COMPANY.
MACHINERY DEPARTMENT.
WELDON, Aug. 13, 1890.

General Foreman:

Sample. Please make and send to Clinton, Ill., for W. Griffin, M. M., the following articles: and charge labor and material to Shop Order No. 2,168. Have tires turned on two pairs drivers, and furnish new driving axles and crank pins.

Received on Car 21,925.

W. H. V. ROSING, *Acting Master Mechanic.*

Master Mechanic:

Sample. Shop Order No. 2,168. Dated Aug. 13, 1890. For two pairs drivers for Clinton.

Completed Sept. 25, 1890.

F. W. BAKER, *General Foreman.*

STANDING SHOP ORDERS.

Nos.	Kind of Work. (For stock only)	Final Charge.
2050	Construction of new frogs	Manufactured material.
2051	" " " switches	" "
2052	" Loco. brass work	" "
2053	Stove pipe	" "
2054	Tin work	" "
2055	Babbitt & solder	" "
2056	Car seals	" "
2057	Jerome packing	" "
2058	Boring new tires	Wheels & tires.
2059	Fittings for water tanks	Manufactured material.
2060	Air brakes	Divide among pass eng.
2061	Safety valves	Manufactured material.
2062	Rubber gaskets	" "
2063	Tapping nuts	" "
2064	Stevens packing & expansion rings	" "
2065		
2066		
2067	Fitting truck & tender wheels	Wheels & tires.
2068	" " " " axles	Axles.
2069	Copper gaskets & ferrules	Manufactured material.

All other work will be done on special shop orders, and no work will be done until shop order has been issued.

S. O. No. 2,168.

1890.	Material.			
Aug. 28....	½ lb. waste	8c.	.04	
" 28....	2-7" iron driving axles, 1,570 lbs.	4¼c.	$66.72	
Sept. 3....	1 bar 2" rod B. B. iron, 210 lbs....	2c.	4.20	
Aug. 30....	1 lb. waste		.08	
Sept. 11....	3 eccentric straps, O. No. 67 and O. No. 68, 370 lbs.	1½c.	5.55	
" 16....	2 eccentric straps, O. No. 68 and O. No. 69, 122 lbs.	1½c.	1.83	
" 23 ...	Old steel axle, 250 lbs.	1c.	2.50	
" 18....	4 galls. kerosene	13c.	.52	
" 18....	1 steel crank pin, 90 lbs.	9c.	8.10	
" 18....	1-14" mill bast. file		.25	
" 18....	2 sheets emery paper	2c.	.04	
" 26....	16-1" Hex. nuts tapped, 10 lbs....	6c.	.60	
				$90.43
	Credits.			
Aug. 28....	2 old driving axles, 1,200 lbs.	1c.	$12.00	
" 28....	4 old crank pins, 80 lbs.	1c.	.80	
Sept. 18....	Old eccentric straps, 350 lbs.	½c.	1.75	$14.55
				$75.88

Have tires turned on 2 pairs of drivers, and furnish new driving axles and crank pins.

"Labor." Ship to *Total.*

W. GRIFFIN, M. M.,
Clinton, Ill.
Charge "Clinton Shops."
Sept. 25, shipped on car 20,731.

$95.23 Closed Sept. account, 1890. $17.111

A passenger on a Canadian Pacific train tells of the following thrilling accident to the through express train in the mountains: "A rail gave way at a point on the mountain side high above the Columbia River. The engine passed over safely, but two coaches following swung about and toppled over. The bank there was very perpendicular, and the cars would have tumbled several hundred feet below into the flowing river had it not been that the coupling twisted around and held the tremendous weight. There were the two cars, one with its load of passengers, suspended between heaven and earth. The weight of the engine and the rest of the train prevented the suspended cars from drawing the whole train down. The suspense was dreadful. The frightened passengers were compelled to remain in their perilous position until train hands built a platform around and underneath the hanging cars, enabling all to make their escape. The place where the accident occurred is considered the most dangerous in the mountains."

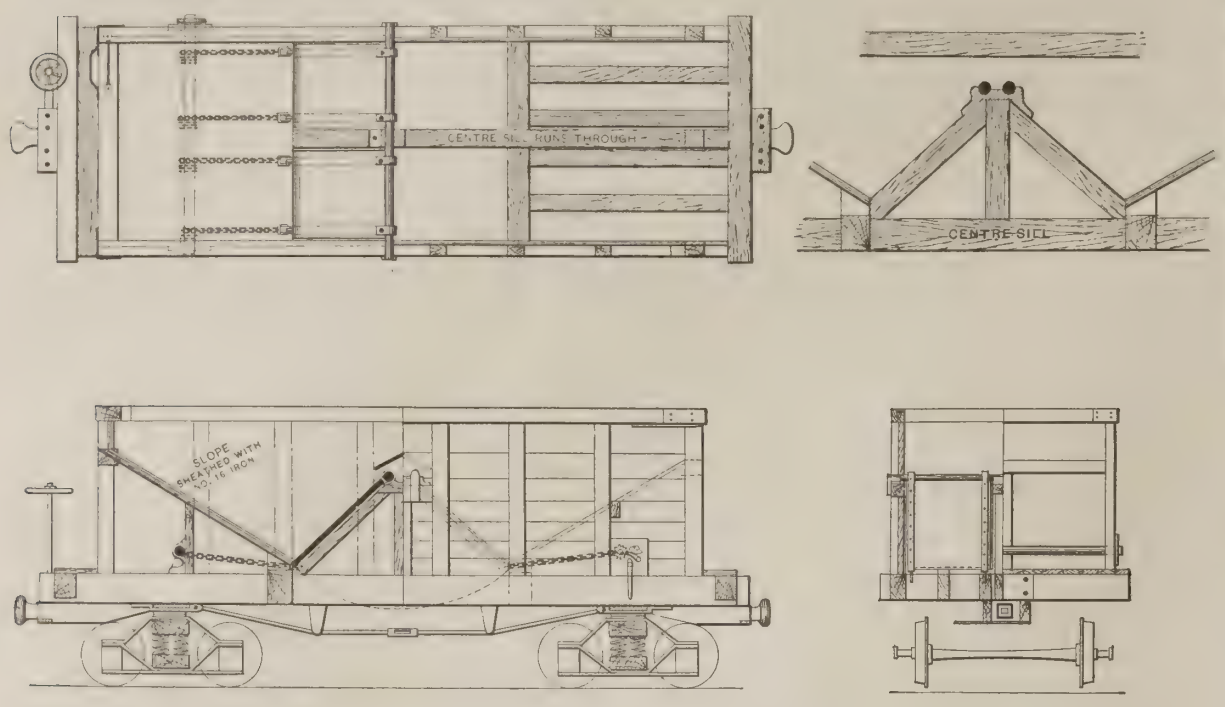
Tomlinson's Dumping Car.

Annexed engraving illustrates an improved form of dumping car, invented by Mr. J. G. Tomlinson, Master Mechanic of the Alabama Great Southern. Mr. Tomlinson writes us about the car as follows:

I enclose you tracings of a dump car I have recently designed and patented, and which has been adopted as the standard of this system.

The main object of the design is to prevent the doors hanging so close to the rail when open.

I do away with the forgings necessary for the ordinary fittings of doors for bottom dump cars, and to make the doors easy to remove for repairs and renewals. To prevent the lifting shafts coming in contact with the load and thereby being subject to breakage, and preventing the proper ease in dumping; and, in fact, to provide a strong simple car, specially for dumping iron ore, rock and sand, while it may also be used for coal.



Attitude of Railroad Companies Toward Employees.

In his address at the opening of the Locomotive Engineers' Convention at Pittsburgh, Oct. 16, Mr. Depew, President of the New York Central, said:

In the United States our pace is so rapid and our development so phenomenal that without due consideration we rush rapidly to extremes. This is true both of capital and labor. The money required to construct telegraphs, to build railroads, to establish banks, was beyond the power of the individual, and so the State permitted aggregated capital, representing the contributions of many, to perform these works. At the same time, through commissions, departments and State officers, the hand of the Government was constantly upon them for the protection of the public against extortion or discrimination. But within a few years everything, from pine lands to peanuts, and from steel rails to sardines, has been organized into some form of corporation or trust. This universal effort to absorb the individual, to divide the people into employing companies and employés and to destroy competition will inevitably end in disaster. Hostile legislation and the laws of trade will leave only the legitimate enterprises surviving. In the same way and from the same causes there have been several ambitious attempts to form gigantic labor trusts, which should combine under one central and autocratic authority every occupation in which a wage-earner or a bread winner could engage. In all such associations of trades and occupations having nothing in common, certain qualities of audacity, fluency of speech and capacity for manipulating caucuses and conventions, push to the front many men who know little of the great interests confided to their care. Labor must be as intelligent as capital upon its own grounds. The committee which calls upon the employer or the railroad officer must know its own business as well as he does, otherwise from angry contentions because of ignorance, comes the exercise of brute force, and violence fails to secure that which in nine cases out of ten could have been had by intelligent presentation. Hundreds of committees of our employés have been to see me, and I can safely say that after the full and free discussion which always took place not one of them ever went out of my office except to carry back a satisfactory message to their constituents.

I do not mean that what was asked was always granted, because an intelligent committee when it meets the President of the railroad and sees the other side always modifies and sometimes abandons its demands. The reason for these ready settlements was that the men understood their business, and knew precisely what they wanted, and how much the company could afford to concede. But in the operations of what I may call the labor trust I have had three experiences. A force of fifteen men were located at one point on the line and in common with other trades in that neighborhood, were members of the local assembly. The chief of that assembly was a shoemaker who had a quarrel with a passenger conductor, and to get even with the railroad, ordered these men to quit work. They lost their places, with all the attendant misery to themselves and their families, without knowing why they were ordered out, nor have they ever to this day presented any statement. A high official in the order called upon me by an appointment made by his private secretary. In discussing the alleged grievance, which he came to correct, I speedily discovered that he knew nothing either of the character of the work, or the wages paid, or the hours of service of the people whom he represented. He then confessed that he never had been in the railway service, or worked an hour upon a railroad in his life. Such representatives of organized labor bring it into disrepute both with employers and with the public. No matter how able a man may be as a cabinet maker or a carpenter, or a mason, and no matter how competent to represent his own trade, he would be absolutely helpless in endeavoring to argue the claims of a Brotherhood of Locomotive Engineers, and the locomotive engineers educated in the principles of the Brotherhood would never attempt to speak, except of that which they thoroughly understood—their own business, and that of their brethren.

A committee called upon me last fall with a series of complaints and demands, all of which were quickly and satisfactorily adjusted. They then made a demand for the locomotive engineers. I said to them: "Gentlemen, that is a body able to speak for itself." They then said that their object was to break up the organization of locomotive engineers, and to gather into the one organization every department of the railway service, and that if the management of the Central road would recognize the claims of engineers only through them, this result will be brought about and upon a much lower basis than the Brotherhood could admit under their rules, and if we did not do so they would strike and tie up the road. I said to them: "I regard the Brotherhood of Locomotive Engineers as the best labor organization in the United States; as a safeguard both to the public and to the corporation, against unreasonable demands or intemperate violence, and you may do your worst, but in a matter which affects the Brotherhood I will recognize only them."

A Monster Bridge Project.

It seems to be settled that a great bridge over the Hudson River to carry railroad passengers from all lines centering in Jersey City right into the heart of New York, without change of cars, will soon be under construction. The project has advanced so far that nothing can stop it but a failure to sell the stock and bonds, and that is not anticipated. It would be a great thing for New York to have direct railroad connection with the whole country, and it would also be a convenience to passengers now condemned to the use of ferry boats and to being landed in a part of the city that very few want to visit.

The bridge will be a little longer than the Poughkeepsie bridge, which is 2,800 feet, and will have its Jersey terminus on the heights south of the Palisades. The New York terminus will be in a gigantic union depot built on the plan of the Philadelphia depot, elevated above the street. The depot will be located on Broadway, at a point between West Twenty-third and Forty-fourth streets, and will be 1,300 feet long by 400 feet broad, the largest railroad depot in the United States.

At the Jersey terminus connection is to be made with all the railroads now landing on the Jersey shore, and on the New York side connections will be made with all Eastern and Western lines running into the city, and with the elevated railroads.

The bridge will be 155 feet above mean high water mark in the centre of the span, and will be 150 feet above the street at its ends on the two shores.

The streets will not be interfered with in regard to traffic by its lines, and property will not be injured or disturbed by the structure.

A curious accident occurred to the locomotive of train No. 46 of the Baltimore & Ohio Railroad, one night. While running at a good rate of speed near Barnesville, on the Metropolitan Branch, a large owl flew into the locomotive headlight, smashing the heavy glass front into smithereens and overturning the lamp. This set fire to the lantern, which was destroyed. His owlship was cooked, head, feathers, feet and all.

The South Side Elevated Railroad Company in Chicago are considering the advisability of using compound locomotives exclusively in the operation of the road. The account of the working of the Rhode Island locomotive that appeared in the last number of the NATIONAL CAR AND LOCOMOTIVE BUILDER has induced the officers of the company to investigate the subject, and it is likely that they will make compound locomotives their standard power.

From the vitals of one of its far away exchanges the *American Machinist* has learned that the cunning Chinese have discovered that the impressions of no two persons' thumbs are alike. The European police keep books of photographs to identify criminals; the Chinese police keep merely impressions of each criminal's two thumbs, carefully labeled and numbered. He may shave, he may appear young and lithe, or old and crippled, but he cannot alter the impressions of his thumbs, which can at any time be traced on paper, and compared with the impressions always kept in safe custody by the celestial detective force. We commend this discovery to the attention of railroad passenger agents who are always cudgeling their brains to find out some way of keeping up the identity of persons buying excursion tickets. All rules against transferring such tickets have always been ridiculous failures. We recommend that the rule of thumb be now tried.

It is difficult for an ordinary reader to comprehend the enormous passenger traffic done on the elevated railroads of New York even when they read that over 188 millions of passengers were carried during the year past. This was done principally in six hours each day when the rush of passengers is moving up and down town. The daily business is over 500,000 persons. There are 32 miles of double track operated by 266 locomotives that never have more than five cars and only three during the time of light travel. The number of passenger cars employed is 918. Each day the number of trains moved would make a single solid train over 100 miles long. At some of the stations, during commission hours, the sale of tickets is done at the rate of over 80 per minute. Trains run on intervals of one and a quarter minutes apart. It is impracticable to run trains closer than that. The business of the road keeps rapidly increasing and they are already at the limit of their capacity during the busy hours. Each car is supposed to accommodate 60 persons but 100 often crowd in.

A test was recently made at Albany, N. Y., of an emergency brake for street cars that appears to have merit. On the State street hill the track was greased for a couple of blocks and the car was suffered to get under rapid headway. The ordinary brakes were then applied, and they only sufficed to check the revolution of the wheels, the car sliding on down the hill at a scarcely diminished rate of speed. Next, the new brake was applied, and stopped the car within twenty feet of its first application. The test was regarded as very successful. The new brake consists of two wedge-shaped blocks, which, by means of rods and a lever attachment connected with the front platform machinery, manipulated by the driver, are dropped when needed close down upon the track in front of the rear truck wheels and pressed against them. The principle of the device is much the same as that of the old shoe and chain drag-brake, which farmers are accustomed to use when drawing heavy loads in hilly districts.

In England there is constant pressure by the Board of Trade on all railway companies to adopt every practicable life-saving appliance. Passenger trains which exceed a twenty-five mile run without stops must be furnished with automatic continuous brakes. Bridges are inspected frequently by qualified engineers in the service of the government. Before a new road can be opened for traffic it must meet the requirements of the Board of Trade. The speed of trains must be proportioned to the weight of the rails per yard and the weight on the driving wheels of the heaviest engines used. Every accident is the subject of immediate investigation on the spot by competent men, who draw up a report embodying all the facts ascertained, with their conclusions and recommendations. The absolute block system, interlocking switches and signals, and the avoidance of facing switches where possible, are in general use on all important railways. If a system of this kind were adopted for American railroads, it would greatly diminish, if not entirely stop, the terrible accidents that are becoming a disgrace to the management of our railroads.

The Heating and Ventilating Apparatus at the Pennsylvania Shops, Walls Station, Pa.

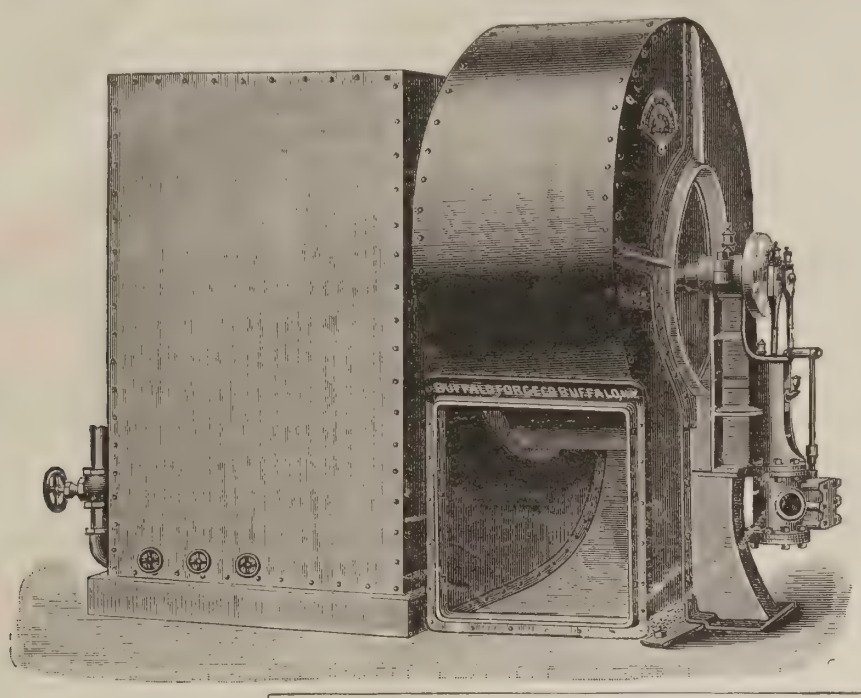
A quite marked improvement in the hot-air system of heating has been placed in the Pennsylvania shops at Walls Station, Pa., by the Buffalo Forge Co. The space heated is the car round-house of the Pennsylvania Railroad, some 500 ft. in diameter. The fan and heater house is built separate, and the air ducts circle in both directions from the fan and heater, almost meeting at the opposite side of the round-house. The outlets are located at equal distances apart and hang from above, 8 ft. from the floor.

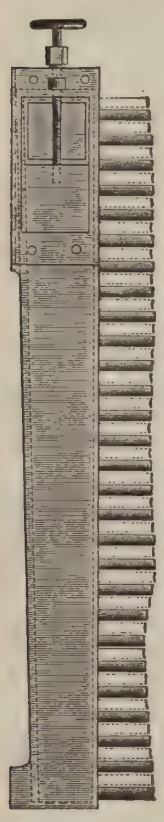
The special features of the apparatus are, of course, the fan and heater. The accompanying cut, Fig. 1, shows a fan and heater, as ordinarily used. The heaters are so constructed as to take in exhaust and live steam, according to the weather, special inlets being prepared for the exhaust of the fan engine, for the exhaust steam from main engine when in use, and also for live steam direct from boiler when necessary. The sections of vertical heater pipes are connected by the cross pieces at the top, and the sides of the manifold sections are corrugated, fitting closely together when placed in the heater, and providing an equal spacing distance between the adjacent pipes of associate sections. The drip and steam inlets are made of good size and direct, so as to prevent any possibility of back pressure upon the engine when exhaust steam is used.

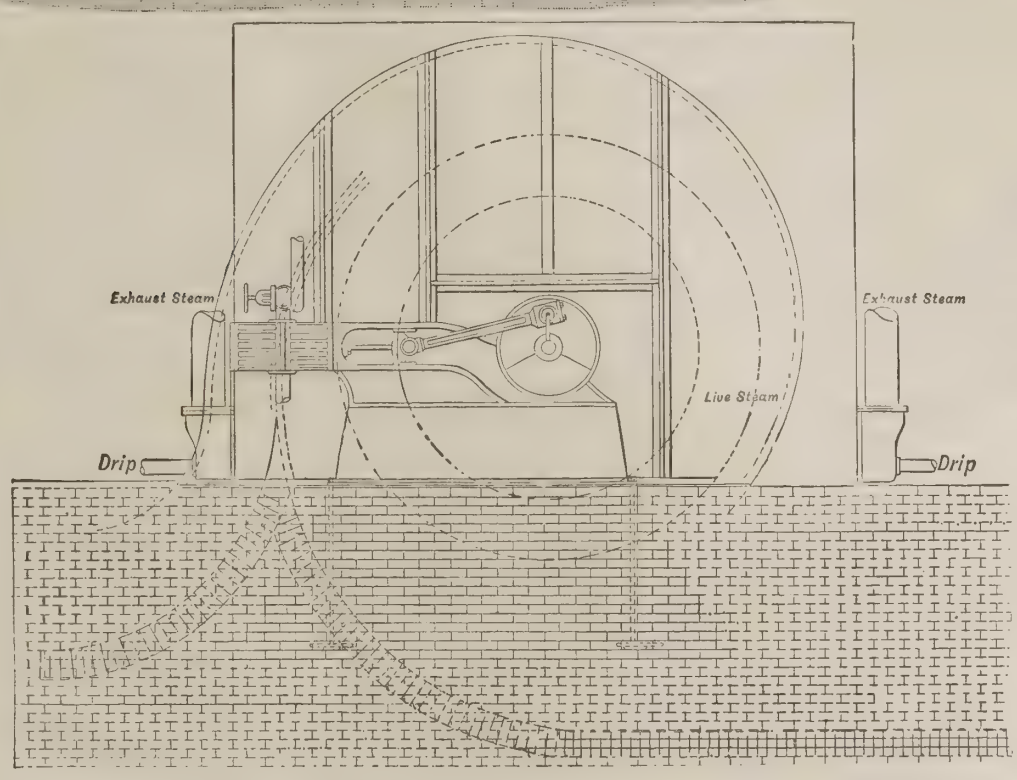
The heater is jacketed with steel plates, one end being left entirely open to insure the air being drawn equally across all portions and locations of the heater pipes or coils. The opposite end is fitted to the inlet nozzle of the fan. The heater coils are so located that any one of the several sections may be removed at will without disturbing the others in their places.

An elevation and plan view of the complete heat supplying apparatus, as constructed for the Walls Station plant, are shown in Figs. 2 and 3. The fan is provided with a three-quarter housing of steel plate, the lower portion being of brick, to form the foundation for engine and wheel bearings. It is 20 feet and 3 inches in height over all, and has a 12-inch × 12-inch horizontal engine.

A special feature of this apparatus is its usefulness in both summer and winter, furnishing in either case air, fresh, clean, and suitable to the season. By merely shutting off the steam from the heater the engine may be operated to force cool air through the pipes and ducts for purposes of ventilation.







Messrs. Watson & Stillman, New York, have just issued a pamphlet with views, etc., of their hydraulic shield apparatus.

The general offices of the Dunham Manufacturing Company have been moved to 703-707 Phenix Building, Chicago.

During the month of October Byram & Co., Detroit, received orders for 17 Colliau cupola furnaces having a melting capacity of 664 tons.

The Messrs. J. S. and W. S. Silver, for many years connected with Richard Vose in his car spring business, having interested themselves in other lines of railway business, no longer represent the Vose interests in any particular.

We have received a new pamphlet issued by the Eureka Tempered Copper Company, respecting the tempered copper which they are making for bearings and other rolling stock purposes. Numerous testimonials regarding the high value of the copper are given.

Mr. Richard Vose intimates that the Richard Vose Car Spring Company will hereafter conduct the business relative to his "graduated" springs for horse, cable, electric motor and steam railroad cars, which has for so many years been conducted under his own name.

"Emery Wheels" is the title of an illustrated pamphlet published by Brown & Sharpe, Providence, R. I. The pamphlet contains a great deal of useful information about the selection and use of emery wheels, and it ought to be in the hands of all the men responsible for keeping this highly useful tool in working order.

We have received from the Schoen Manufacturing Co., Pittsburgh, Pa., a newly prepared illustrated catalogue of the pressed steel articles made by the firm. We have seldom seen anything artistically equal to the work on this catalogue. It is a good introduction for the variety of steel forms offered by the company, the engravings being so plain that a sample of the goods is not necessary.

The best way to take the lead is the constant bringing out of new ideas for the saving of time and labor in the working of wood of all kinds. This has given them, say the Egan Company, of Cincinnati, O., U. S. A., the most commanding position of any concern in their line in the world. Their productions are famous in all climes and nations, and are always the latest forms for economical and perfect work. They can supply almost any want.

We have received from the consolidated Safety Valve Company, New York, an illustrated pamphlet showing the different forms of safety and relief valves made by the firm. In addition to very good and comprehensible cuts of a great variety of valves, the pamphlet contains much valuable information on boiler pressure and the means of relieving it which all engineers ought to be familiar with, although many of them are not. The pamphlet will be a useful hand book and ought to be within reach of all steam users.

A correspondent directs our attention to the fact that the Connelley radial taps made by the inventor, a practical boiler maker at Milton, Pa., enable a workman to provide against the fault in tapping sheets adverted to by a correspondent in the November number of the NATIONAL CAR AND LOCOMOTIVE BUILDER. The Connelley taps are hollow and work on a threaded spindle which acts as a guide and insures coincidence in the threads of the two radial sheets. This tap ought to be more used by railroad mechanics.

The Pennsylvania Railroad Company are erecting at Jersey City an elevated railroad structure, over one mile long and four tracks wide, on which their entire passenger travel of millions of people will enter and leave the city. The iron work, which has 13 feet street clearance, is immense in its proportions, and was made and erected by the Pencoyd Iron Works. It is a marvel of accurate and substantial construction. It has been the practice of the P. R. R. Co. heretofore to use a light-colored paint on all of their iron structures, but after a thorough examination into the merits of Dixon's silica-graphite paint they chose that as the paint for this work.

The Ashcroft Manufacturing Company, of New York, have published a new illustrated catalogue showing cuts of the leading articles manufactured by the firm. Their specialties are all sorts of pressure-measuring and controlling apparatus, and all sorts of connections for steam boilers and engines. They make gauges from the beginning to the end of the gauge family, and it is a pretty fertile one, to judge by the likenesses found in the book. Then there are all sorts of pipe-cutting, threading and fitting appliances, cocks and valves to suit most purposes, oil cups of select patterns, the Tabor steam engine indicator, injectors, and nearly all other articles needed in a complete steam fitting establishment.

Professor Thurston, director of Sibley College, Cornell University, Ithaca, N. Y., has issued a circular to manufacturers of testing machines, intimating that the college is in the market for the purchase of a testing machine with a capacity of at least 200,000 pounds. The circular says: In making proposals, it is respectfully suggested that consideration be given to the fact that this institution is not engaged in business, and is not making money; but that it is a great philanthropic enterprise, established by the State and by benevolent men for the express purpose of offering to the sons and daughters of every citizen a means of obtaining such an education, liberal or technical, or both, as may be considered best for his or her purposes. Every dollar saved, in purchases of this kind, permits the University to extend its beneficent work. Large special discounts are therefore frequently given, very often amounting to 100 per cent.

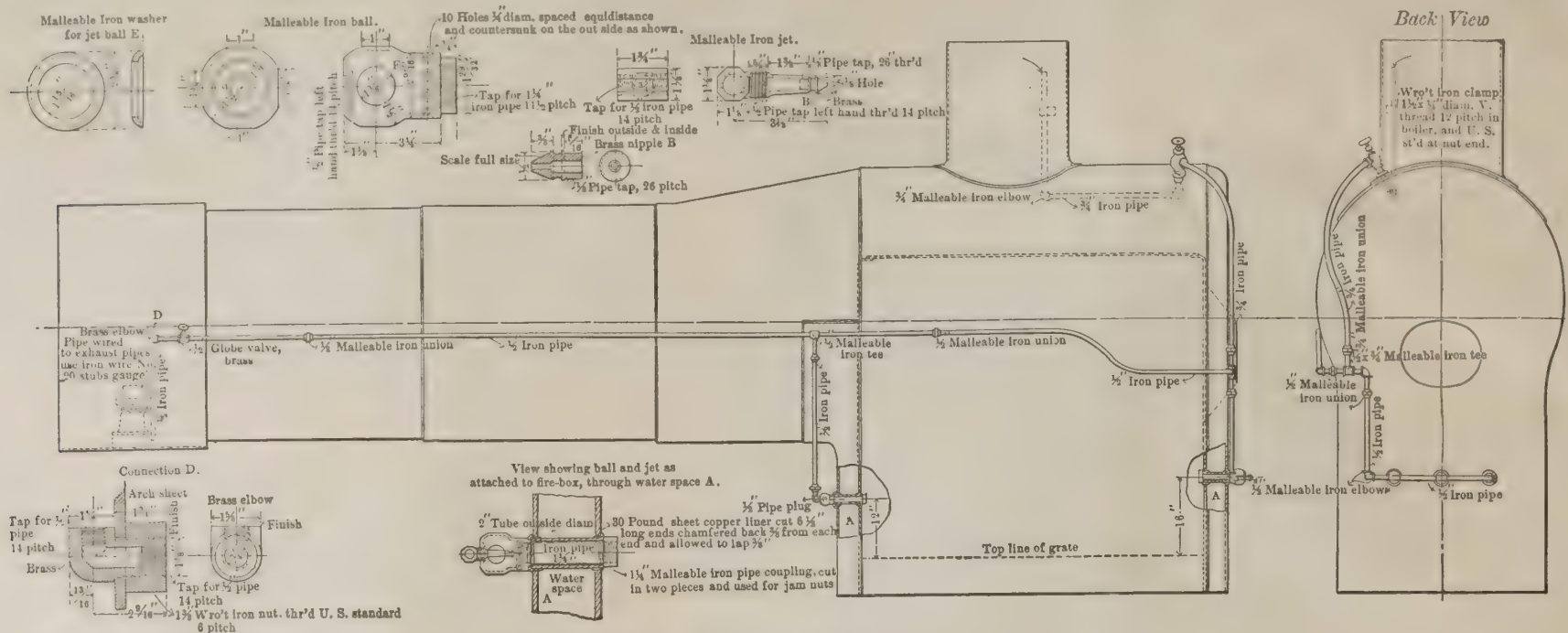
The Elmore Car Axle Box Lid Company, of Chicago, report a rapidly increasing demand for that lid, which appears to give the greatest satisfaction wherever it is applied to oil boxes. The company's officers say that while it is a comparatively new lid, it has already taken first rank, and is now standard on a number of railroads. It is a gravity lid pure and simple, with no nuts, bolts, springs or hinges to lose or get out of order, and cannot jump up or down while car is in motion, thus doing away with the most serious objection to other box lids now in use, some of which wear themselves out, drop down past the face of the box and leave an opening through which dust and cinders may enter. Ordinary care in fitting (no machine work being necessary) will make the lid dust-proof. If left open it will close itself, and when closed makes a perfectly tight cover, excluding all dust and at the same time keeping the oil in the boxes. This lid is made of malleable iron, covering the face of the box and protecting it from breakage from hammer blows. On new cars this lid is put on the box before the latter is put in place in the truck, and when the arch bars are in position the lid can be raised, but cannot be wholly removed from the box, resembling in this respect the Hewitt lid; unlike the latter, however, it can be applied without removing the arch bars, by simply spreading the horns and when in place closing them in with a hammer. On the top of the opening of the box a rib or flange is cast, and in addition to this a trunnion three-quarters of an inch in diameter on each side. The lid also slides on a wedge on each side of the box. These are the only changes in the pattern of an M. C. B. box necessary for the application of this lid.

Watson & Stillman, makers of hydraulic machinery in New York, have written to the *American Machinist* saying that a blackmith in that city has discovered a secret process which enables him to draw the temper of mushet steel.

The Western Locomotive Company has filed articles of incorporation at Seattle, Wash. The company is to manufacture and lease locomotives and portable engines. The capital is placed at $2,500,000. Seattle will be the principal place of business. John L. Ayer, Joseph Hadurger and F. D. Burton are the incorporators.

The stevedore rope, manufactured specially by the C. W. Hunt Company, New York, for use in transmission of power and hoisting purposes is said to give the greatest satisfaction to those who have tried it. The rope is thoroughly lubricated internally with tallow and plumbago, so that in passing over pulleys the strand fibers in moving each other do not chafe, and the life and service of the rope is prolonged.

We publish in this issue an illustration of the Hutchinson Water Gas Furnace, as applied to locomotives. The illustration is taken from an engine on the Lake Shore & Michigan Southern Railroad and made by Mr. Wm. Gilmore, master mechanic at Elkhart, Ind. This device settles the smoke nuisance question in a practical manner, by setting the gases, soot and cinders on fire in the fire-box and thereby reducing that portion of the fuel formerly scattered over the patrons of the road into heat. There is no longer any necessity that passengers should ride in a cloud of smoke and a shower of cinders. About twenty per cent. of the fuel bought by railroads has been expended in that manner.


Malleable Iron washer for jet ball E.
Malleable Iron ball.
10 Holes ¼" diam. spaced equidistance and countersunk on the out side as shown.
Malleable Iron jet.
Tap for 1¼" iron pipe 11½ pitch
Tap for ⅜ iron pipe 14 pitch
Finish outside & inside
Brass nipple B
Scale full size
1¼ Pipe tap, 26 pitch
Pipe tap, 26 thr'd
Hole
Brass
Pipe tap left hand thr'd 14 pitch
Back View
Wro't iron clamp 1½x¼" diam. V. thread 12 pitch in boiler, and U. S. st'd at nut end.
¾" Malleable iron elbow
¾ Iron pipe
¾ Iron pipe
Malleable iron union
¾x¾x¾ Iron Pipe
¾x¾x½" Malleable iron tee
½" Malleable iron union
½ Iron pipe
½ Malleable iron elbow
½ Iron pipe
Brass elbow Pipe wired to exhaust pipes use iron wire No. 10 stubs gauge
½ Iron pipe
Globe valve, brass
⅛ Malleable iron union
½ Iron pipe
½ Malleable iron tee
½ Malleable iron union
½ Iron pipe
½" Pipe plug
Top line of grade
18"
Connection D.
Arch sheet
Brass elbow
Finish
Tap for ½ pipe 14 pitch
Brass
Tap for ½ pipe 14 pitch
1⅜ W'ro't iron nut. thr'd U. S. standard 6 pitch
View showing ball and jet as attached to fire-box, through water space A.
2" Tube outside diam
30 Pound sheet copper liner cut 6½" long ends chamfered back ⅜ from each end and allowed to lap ⅜"
Iron pipe
Water space
1¼" Malleable iron pipe coupling, cut in two pieces and used for jam nuts

HUTCHINSONS' SMOKE-CONSUMING APPARATUS.

The Corey Car and Manufacturing Company.

This concern, which has for several years been doing a prosperous business in the construction of mining plants and mining cars, portable track and switches, construction and logging cars, have recently made a large addition to their capital stock, and are about erecting large works at Waukegan, on the line of the E. J. & E. Railway, which will give connections with every road to the East, South and West from Chicago.

Their plans contemplate the erection of several large buildings, comprising a machine and wood shop in brick, which will be 85 by 200 feet, with an additional erecting shop of the same size; also a foundry building on modern principles, with center crane having a radius of 60 feet. In addition to this they are putting up a blacksmith shop and boiler room.

This concern makes everything in mining supplies, including steel dump cars, hoisters, hoisting engines, etc., and with their increased foundry facilities they will be enabled to make almost any size of castings for heavy engines or steamboat work.

The property recently acquired by this company covers ten acres of ground, and the preliminary work on same will be commenced within the next few days.

We understand it is also their intention to engage in the construction of electric motors and finished street car work, for which suitable paint shops will also be constructed.

The offices of this company are in the Phenix Building, Rooms 301, 302, 303, to which place all orders or inquiries should be addressed.

Merriman Bolt Cutter, Chuck and Die.

Most of our readers who are connected with rolling stock construction or repair are familiar with the Merriman bolt cutter. Annexed we illustrate what are the vital parts of this machine, viz., the chuck and the die. The chuck consists of four principal parts:

(1). The die-box, which is made of steel, and contains the four die slots, in which the dies are accurately fitted and firmly held.

(2). The ring, which surrounds the die-box and receives the thrust or bearing of the dies when in operation.

(3). The flange, which slides longitudinally upon the spindle, or shaft, in the rear of the ring, to which it is attached by two screws that pass through the two long slots, into holes in the rear of the ring (not shown in the cut).

(4). The cap, which is secured to the die-box by four screws that pass through the four holes in its face.

In the rear of the die slots are the four small levers, or "dogs," that serve to lift the dies from the bolt when the thread has been cut. As the flange and ring are fastened together by the slot screws, when these parts are drawn back by means of the lever (see large cut), the rear ends of the "dogs" are depressed, and the front ends, engaging under the projection or "nib" of the dies, lift the dies and release the bolt. When the ring is brought forward, it strikes the incline on the dies (see cut of the die), and they are forced down in their slots and are again ready for service.

Inside the ring are three sets, or series, of hardened steel eccentrics, on the outer one of which the dies have their thrust, or bearing, when in working position. By loosening the two slot screws the ring may be rotated independently upon the die box a distance governed by the length of the die slots, thus causing the eccentrics to operate upon the dies for their adjustment to such a degree as may be desired. By this means the dies may be made to cut the bolt to the exact size needful to make a tight or loose fit in the nut, as may be desired.

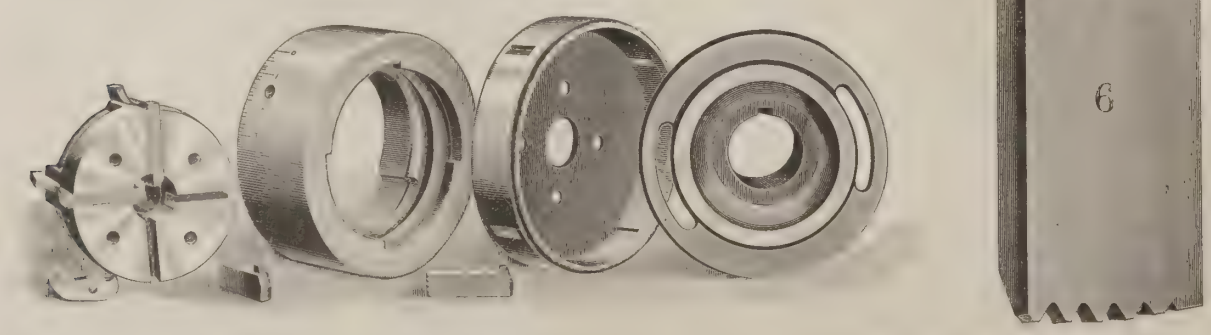
The Merriman die is made of a plain piece of steel, milled or planed so as to leave a short "nib" or projection, under which the "dog" engages and lifts the die from its work. It is cheaper to make than any of the compound "traps" called by the various names of "case," "cap" or "hat" dies, though such dies can be furnished to any one who may be in favor of them.

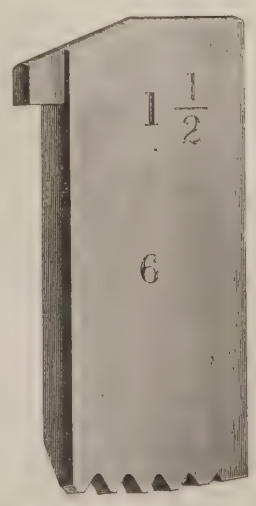
These dies can be re-cut several times for their original size of bolt; and after that capability has been exhausted, they can be re-cut for use on larger sizes of bolts, that do not require so long dies. When these possibilities are exhausted, the balance of stock rejected is a very insignificant item.

It will be observed that the dies have a square head which has a thrust, or bearing, on the inside of the solid, hardened steel ring. This gives them a solid and absolutely unyielding bearing, and they are therefore as unyielding as a solid die, with all the advantages that follow the releasing of the bolt when threaded. Hence, the product must be uniform—every bolt exactly the size of every other—a most important and indispensable essential of a bolt cutter, and lacking which all other good qualities are of no avail.

No adjusting screws are used. Any die that depends for its bearing or adjustment upon a screw, is particularly unmechanical and objectionable.

No die having an incline extending its entire width can possibly afford an unyielding and solid bearing, no matter how it may be "locked." It affords an opportunity for the dies to yield a little, and that "little," as any skillful mechanic knows, measures the difference between a good fit and no fit at all! A square bearing, like the merriman die, needs no "lock" whatever. It is a "solid die" in itself.





A new elevator, of 1,500,000 bushels capacity, for the New York Central Railroad, has just been completed at Sixty-first street, North River. Its chief feature is the solid iron posts that form the rib work of the building, each composed of several lesser ones riveted together and towering 150 feet to the roof. The doors leading from the tower to the elevator are of iron, likewise the big doors that close the arched entrances for the trains.

Mr. Mead Moore, recently connected with the West Shore and Hoosac Tunnel lines, has embarked in the railway supply business, with office in the Phenix Building, Chicago.

The Standard Paint Co., New York, have published a pamphlet setting forth the value of their building and insulating papers, containing testimonials from various users giving their views of the material. It is used largely in the construction of refrigerator cars, and is said to make them absolutely moisture proof.

Our Directory.

We note the following changes during last month:

Atchison, Topeka & Santa Fé.—M. Emery to be master mechanic at Arkansas City, Kan., vice D. C. Courtney, resigned.

Atlantic & Danville.—R. M. S. Wortley appointed vice-president and general manager, vice C. B. Peck, resigned.

Austin & Northwestern.—A. Rosevelt has been appointed master mechanic.

Chicago & Eastern Illinois.—C. J. Clifford has been appointed acting general master mechanic.

Chicago & Erie.—F. E. Merrill has been appointed superintendent, with headquarters at Chicago, in place of C. L. Mayne, resigned. E. B. Sheffer, purchasing agent; Ross Kells, superintendent motive power.

Chicago, Rock Island & Pacific.—C. L. Ewing, superintendent of the Southwestern division, has been appointed superintendent of the Illinois division, with headquarters at Chicago, in place of Mr. R. H. Chamberlain, assigned to other duties. H. A. White has been appointed superintendent of the Southwestern division, with headquarters at Trenton, Mo., in place of C. L. Ewing, transferred.

Columbus & Western.—J. E. Clemence has accepted a position as master mechanic of the company's shops at Columbus, Ga.

Connecticut River.—John Mulligan, superintendent, has been elected president, vice N. A. Lronard, deceased.

Fort Worth & Denver City.—John F. White has been appointed Master Mechanic of the road, with jurisdiction between Fort Worth and Texline, with headquarters at Fort Worth, Tex.

Georgia Southern & Florida.—Geo. D. Harris appointed Master Mechanic.

Gulf, Colorado & Santa Fé.—Sullivan H. Morris has been appointed Superintendent of the southern division, with headquarters at Temple, Tex.

Milwaukee, Lake Shore & Western.—H. W. Reighley, Purchasing Agent, has resigned the position.

Missouri Pacific.—F. Reardon has been appointed superintendent of motive power.

New Orleans & Gulf.—J. A. Larned has been appointed general manager. Headquarters, New Orleans, La.

New York Central & Hudson River.—Clinton L. Rossiter has been appointed superintendent of the Harlem Division, with office at White Plains, N. Y., in place of George H. Worcester, resigned.

New York & Greenwood Lake.—B. E. Moodey has been appointed superintendent of this and the Watchung road, vice J. F. Maguire, transferred.

New York, Lake Erie & Western.—J. F. Maguire has been appointed Superintendent of the Western division.

M. W. Maguire has been appointed Superintendent of the Susquehanna division.

Philadelphia & Reading.—A. Foster appointed Purchasing Agent.

Sinnemahoning Valley.—G. A. Caldwell has resigned as General Superintendent.

Southern Pacific.—R. W. Gray has been appointed master mechanic of the Tucson & Gila division.

St. Louis, Arkansas & Texas.—R. M. Galbraith has been appointed master mechanic of the Texas division.

St. Louis, Iron Mountain & Southern.—E. T. Horn has been appointed superintendent of the Central Division, with office at Little Rock, Ark.

St. Louis & San Francisco.—J. R. Wentworth has been appointed general superintendent.

Western New York & Pennsylvania.—C. T. Dabney has been appointed superintendent of the Buffalo division of this road, in place of H. Dwyer, resigned.

West Shore.—J. P. Bradfield, division superintendent, has been transferred to the Buffalo division to succeed D. B. McCoy. W. G. Wattson has been appointed division superintendent, in charge of the Hudson River division, with office at Weehawken, N. J.

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